American Machinist

Established 1877 McGraw-Hill Publishing Company, Inc.

New York, September 4, 1930

VIBRATION

Friend? *or* Enemy?

The results of vibration are cumulative. They are capable of building up a tremendous force for good or evil

◆

Chester B. Lord
Associate Editor

I ONCE worked with an engineer who had a peculiar aptness for solving mechanical problems that seemed unsolvable, and the solution was always simple. Upon being questioned as to how he succeeded where others had failed, he answered: "When I am opposed by a natural law, I reverse my practice and make it work for me."

This is sound advice, and it seems particularly apropos at the present time when we were contemplating the redesign of our machine tools in order to reduce vibration caused by heavy cuts, thus enabling us to utilize tungsten carbide to a fuller extent.

Without question, vibration is a most destructive form of energy when uncontrolled, but it is a self-evident fact that any form of energy may, if properly controlled, be made beneficial in proportion to its possible destructiveness when uncontrolled.

There are two different fields in which vibration can be utilized to the benefit of the shop. One is in damping tool vibrations by counter vibration. The other, a much more promising field, is to convert tool vibration into added cutting power by means of parallel forced vibration, thus making it work for us.

When we consider that all energy is vibratory, and when we review the other arts and sciences where it has been utilized, there does not seem to be much argument against utilizing it further in mechanics. The purpose of this article, therefore, is to suggest possibilities and provide a background for further study and experiment on the part of those who have the facilities for doing such work.

We can follow the utilization of vibration from the slow reciprocation of the Corliss engine down, or rather up, through the gas engine, air hammer, electric hammer, telephone disk, phonograph, vibratory tachometer, musical instruments, alternating current, heat, color, light, and finally to the cosmic rays.

The utilization of mechanical vibration dates back to the first stringed instrument, or the first tom-tom. The Bible tells us that Joshua marched his troops around the walls of Jericho seven times. "Then the trumpets blew and the walls fell." Even though the marching was a maneuver intended to distract attention from the sapping operations of Joshua's men, and the trumpets, instead of being the cause of the walls falling, were a signal for them to fall, we do know that even today an

army band never plays while crossing a bridge, and that the vibration of high explosive shells is used to affect the morale of enemy troops.

In the beginning, man was the victim of the elements of which today he is master. Wind, water, and fire terrified him until he conquered them and made them work for him.

The same thing will eventually be true of vibration. At present we are in the transitional stage of trying to control or diminish its effect. The next stage will be to utilize it. This is particularly true of machine design.

Professor Timoshenko, of the University of Michigan, states that, "Thirty years ago the design of machine parts was based principally on empirical data. Elementary statics was sufficient for studying the forces and stresses acting on machine parts. With the increase in size and peripheral velocity of modern machines, the dynamical side of problems, especially vibration problems, is becoming more and more important."

The impulsive idea of lessening vibration is to increase mass, but with a machine tool, circumstances are entirely different, and the answer, therefore, must also be different. In the first place the vibration to be controlled is not the natural vibration of some one member, and therefore a constant, but it is a variable forced vibration caused by the size and degree of hardness of the piece being machined and the size, shape, and projection of the cutting tool. The important thing to remember is that we are not so much concerned with preventing vibration in the machine itself, as we are in the tool and the piece being machined.

Whether the finally accepted practice with tungsten-carbide tools will be low speeds with heavy cuts, very high speeds with light cuts, or a combination of both has not been definitely settled, and when it is, the piece being machined, or the tool, will probably be the deciding factor, not the machine itself. It is a favorite expedient of entomologists to introduce one variety of insect to destroy another, but in many cases after the invader has destroyed the other insect according to program, it has itself, in turn, become a problem.

WE have had examples of the effect of increasing the mass of machine tools. Where this has been done it has been found necessary to design elaborate fixtures to support the piece being machined. We then had the spectacle of a massive machine removing a very small quantity of material. To overcome this objection, multiple machining was resorted to, and the necessary fixtures are a substantial part of the cost of the machine. This works out fine where the output is continuous and the quantity justifies it. But how about the manufacturer who has to purchase the same machine for a limited output? He must either invest more than the class of work warrants, or else invest in an elaborate fixture that shows a flattering decrease in the cost per piece but which will never pay for itself because of the small quantity.

The "strengthening by mass" idea is not new. The Deacon used it in the one horse shay that "was built in such a logical way, that it lasted one hundred years to a day."

Vibration builds up tremendous forces. These forces must have a safety valve just as any other confined energy. Escape into the mass of the structure results in fatigue, which may or may not cause trouble.

Vibration is set up by two conditions—unequal distribution of a revolving mass, and the constant varying of forces acting in a straight line. It is the latter that we are primarily concerned with, and in the machine tool this vibration is set up in three ways—by unequal pressures caused by the tool digging in and snapping out; by the resistance of hard material that tends to hold the tool back until the force of the feed overcomes the resistance; and by non-rigid material being pushed away from the tool until it springs forward and the tool digs in momentarily. All these phenomena occur under conditions that depend upon the combination of speed and feed at which the machine is cutting.

Generally speaking, vibration is harmful only when the natural period of vibration of the part being machined happens to coincide with the period of vibration set up by the periodically varying force acting in a straight line, i.e., the cutting tool. The primary source of the vibration can be damped by other vibrations not of the same frequency, by vibrations having a similar frequency but not in synchronism, or it may be practically eliminated by opposing vibrations from a different direction, reaching their maximum force at half the frequency of the vibration we wish to damp.

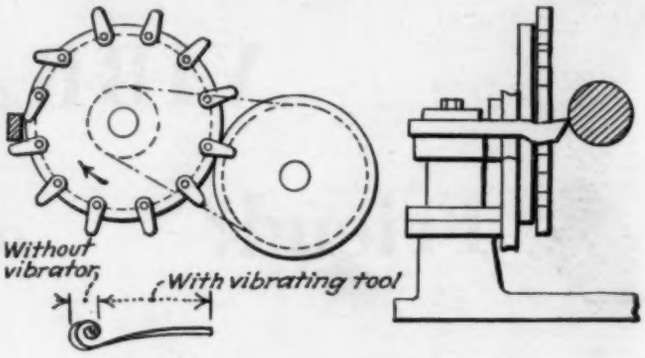


Fig. 1—Experimental vibrator, the arms strike the bottom of the tool

The spiral cutter and the hunting tooth in a gear are examples of what were originally efforts to dampen vibration in machine tools. Equal multiples of teeth in a gear are like troops marching across a bridge in step, the hunting tooth makes it like route step.

The proposal to increase the size and mass of machine tools to eliminate vibration caused by the cutting tool is a step in the wrong direction, because the struggle of mechanical engineering is toward refinement, less weight per horsepower, the extended use of heat treatment, and the use of alloys. This means that machine castings and parts are lighter, of smaller cross section, and, in some cases, comparatively weak before heat treatment. This, in turn, means that the speed and feed, especially the feed, at which a cut shall be taken, are no longer a function of the machine tool, but depend upon the rigidity of the piece being machined and on the method used for holding it.

Under these circumstances, the only way to utilize economically a heavy machine taking a heavy cut would be to design the parts to be machined so that they will fit the feed. Small or fragile parts cannot be machined economically in large machines any more than clock parts can be machined in a tool room lathe. Sensitivity is an essential to accuracy. The alternative is a roughing cut in a heavy lathe and a finishing cut in a light one.

In designing a machine exposed to destructive accidents, one designer provides a clutch, a break-pin, or a weak member that can easily be replaced. Another designer strengthens one member after another until the mechanism is entirely out of proportion to the work it is to do, like the Deacon's one horse shay.

THE second proposal to utilize vibration is to reverse our practice and, instead of merely preventing it in the cutting tool, make vibration work for us in cutting metal. In using vibration, we may be able to get results that are out of proportion to the forces applied, because vibration is cumulative and capable of building up a tremendous force.

Experiments looking towards the application of vibration to the cutting tool of a machine are not new. Patent No. 22195 covering this practice, was issued in Russia, in 1912. More recently, Victor Tatarinoff, of Pilsen, Czechoslovakia, to whom we are indebted for the following information and sketches, undertook experiments along the same line. He gives the result of his experiments as follows: "A utilization of vibratory action in cutting tools is found in pneumatic hammers. These tools require only hand support for taking off chips of considerable cross section. To remove the same size chip on an ordinary lathe would require many times the power, and a very strong tool support. The difference of reaction forces observed might be attributed to the action of repeated shocks of great frequency reducing the attractive forces between the molecules of the metal.

"It seems perfectly feasible to apply this principle to cutting metals, in fact, some time ago we rigged up a primitive vibrator on a turning lathe. This vibrator is shown in Fig. 1. It consists of a pair of pulleys with a rope drive, and is operated by hand. The driven pulley is equipped with twelve swinging arms. When the pulley is up to speed these arms are disposed of radially and strike against the tool at the rate of 1,200 blows per minute.

"The cutting tool used was of $\frac{3}{8}$x$\frac{3}{4}$-in. cross section, and when used in the usual manner, the chip from the $1\frac{1}{2}$-in. bar was curled in a ball like that produced by high-carbon steel. When the vibrator was started the chip was flat instead of curly, and the under part had a mirror-like surface.

"Under these conditions the tool cut much easier and the piece being machined was under noticeably less strain. Therefore it may be stated that a certain reduction in power was obtained. The decrease of chatter in the piece further indicated a decrease of resistance to the cutting action of the tool.

"The experiments showed that, where the vibrations were applied to short, stiff cutting tools, it did not affect the cutting quality to any appreciable degree, but when applied to tools of small cross section, yet long enough to vibrate under the blows, a good efficiency was obtained. But the tools eventually broke. It became clear that any tool to be successful must have unrestricted axial play, but be secured against turning."

Whether or not tungsten carbide will stand up under such conditions I do not know, but high-speed steel surely will. The period of vibration, and the relation between peripheral speed and the hammer speed is also a matter of experiment. At first thought it would seem that the hammer could not keep up with the peripheral speed and would be choked. Further consideration tells us that either the chip will be much smaller than is usual with a hammer, and therefore will offer less resistance, or that, because of the increase in chip size, it will not be necessary to revolve the piece as rapidly to remove the same amount of material. Furthermore, even without vibration, the tool will continue cutting.

The latter contingency should not be depended upon, however, because it is desirable to employ a cutting tool of smaller included angle than at present. This is perfectly feasible when using vibration similar to the air or electric hammer. The tool should approximate the cape chisel in included angle. I think the type shown by Mr. Tatarinoff will prove too fragile and advocate, rather, a tool with a turned-up end like some of our diamond-point tools. Such a tool, hinged at the tool post, would act like a goose-neck tool.

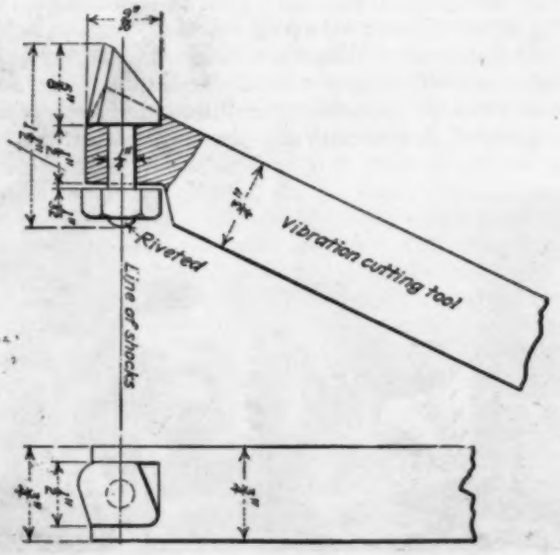


Fig. 2—Cutting tool with free axial movement. This tool form also offers less resistance to cutting

THE peculiar building-up property of vibration and its adaptability to cutting is probably best shown in the electric hammer, which is entirely different in principle from the air hammer. In the latter we have an oscillating piston actuated by air pressure, delivering a multiplicity of blows at the head of a cutting tool. In the electric hammer the blow upon the chisel shank is caused by free vibration. Two gears, weighted like the driving wheels of a locomotive, are driven by a bevel gear on the motor shaft. The two gears revolve in opposite directions, and thus they are alternately a balanced and unbalanced rotating mass.

The striking member rests upon springs and is actuated by the vibration alone. It has no connection with the motor or gears. Such is the accumulation of forces, however, that a small hammer will cut a $\frac{1}{4}$-in. strip from the edge of $\frac{1}{2}$-in. boiler plate. This is at least ten times as large a chip as a lathe with many times the horsepower will remove under ordinary conditions.

Other applications of vibration to mechanics may be found in the printing press, the loom, in a "chatter" press for punching holes, in a metal shear, and elsewhere. Vibration may be conveyed a considerable distance and around corners hydraulically. Mechanically speaking it is a source of tremendous force that is at present largely wasted.

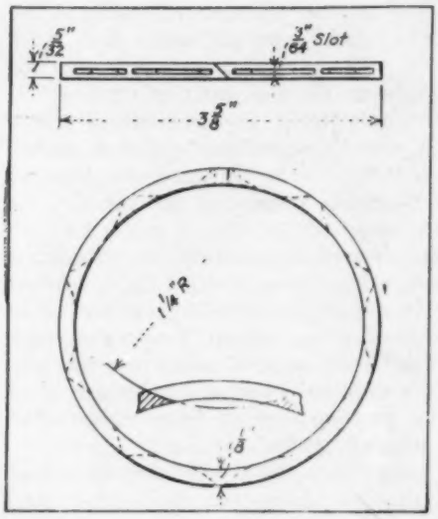


Fig. 1 — Circular grooves in thousands of rings are milled at the rate of 250 pieces per hour

Indexing Piston Rings

Frank W. Curtis
Research Engineer, Kearny and Trecker

A milling machine fixture which demonstrates that high production sometimes justifies complication

NOWADAYS, in producing repetitive work, the aim in most shops is to reduce lost time, and to relieve the operator of as many purely manual duties as possible. Cost naturally enters into such problems, but when large quantities of parts are to be produced, there is ample opportunity to devise cost-cutting methods. The piston rings, shown in Fig. 1, are manufactured in large volume, making the cutting time per piece of primary importance and the tooling cost, to a great extent, of secondary consideration.

The milling operation includes the cutting of ten slots, equally spaced around the periphery of the ring. Since the cut is light, it is possible to mill ten pieces at once by using a gang of saws mounted in the machine as illustrated in Fig. 2. This view likewise shows a close-up of the fixture, principally the work spindle and indexing mechanism. The operation is performed in a No. 1 Milwaukee milling machine; the saws are $\frac{3}{64}$ in. wide, $2\frac{1}{2}$ in. in diameter and are operated at 140 r.p.m. A production of 250 rings per hour, 2,500 grooves, is the average output.

The rings are placed over a hardened steel mandrel, and a sleeve fitted over them, compressing them to the correct diameter. The slots of the rings are all brought to a uniform position in relation to the indexing plate, so that the cutters will not saw through the joints. With the sleeve in place, the rings are clamped by a handwheel that draws them tighttly between a collar and the shoulder of the mandrel. After being tightened, the sleeve is removed and the rings are ready to be milled.

By changing the size of the mandrel, rings of different diameters can be accommodated. Likewise, by using different locking and indexing wheels, it is possible to mill from six to twelve equally spaced grooves around the periphery of the rings. Some rings are made with two sets of grooves instead of one, and by arranging a gang of saws to suit, this style can also be handled in the fixture. Thus a degree of adaptability is obtainable to suit variations in design.

Constructional details of the assembly are shown in Fig. 3. The reciprocating motion of the slide is actuated by means of a drum cam *A*, mounted horizontally in a cast-iron housing, and a roller attached to the projecting end of the fixture slide. The slide is fitted to the base of the fixture by a dove-tail, provided with a gib for take-up. When the drum rotates, the fixture slide moves horizontally with a reciprocating motion, completing a cycle at each turn of the drum cam.

At the left of the drum is attached a worm wheel *B*, which is driven by a worm positioned as shown at *C*. The worm shaft is driven by the drive shaft *D*, through a chain of spur gears mounted in the housing. Power for operation is taken from the feed drive shaft of the machine which is disconnected from the feed box and connected to the drive shaft. The regular machine table is locked in a stationary position, and all motions are attained directly from the fixture. A clutch is employed in the work shaft at *G*, enabling the drive to be disengaged without stopping the machine. It is controlled by the handle *H*, and is disengaged by the operator when loading and unloadiing the work.

Indexing the piston rings is automatically done in synchronization with the horizontal movement of the slide. On the rear end of the work spindle is located an indexing wheel *K*, and a locking wheel *L*, both of which are keyed in place. When the slide is moved from left to right, withdrawing the work from the cutter, the plunger pawl *M*, which engages into the slots of the locking wheel, is automatically disengaged when the heel

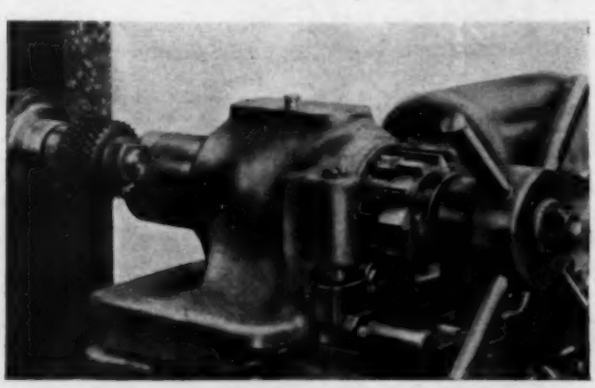


Fig. 2—The reciprocating motion of the slide actuates the indexing and arbor-locking mechanisms

Automatically

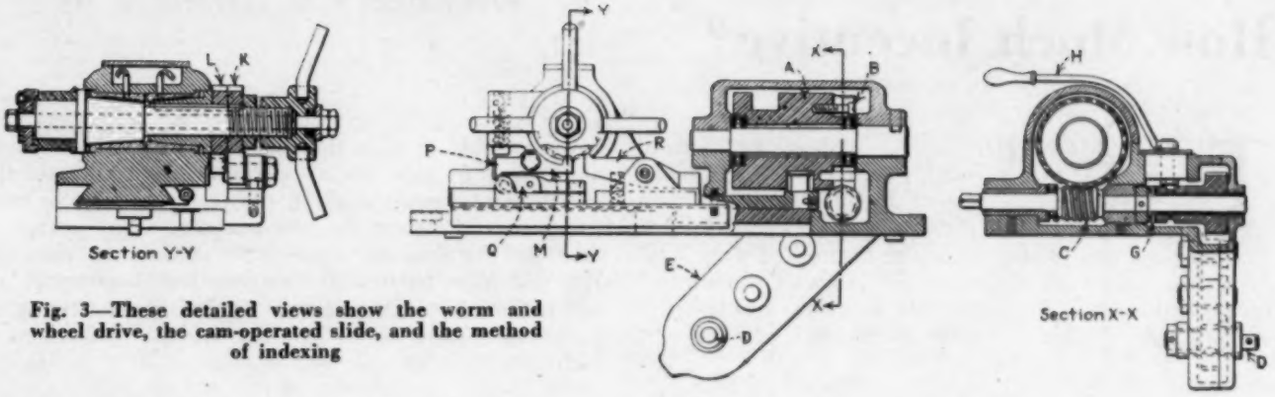


Fig. 3—These detailed views show the worm and wheel drive, the cam-operated slide, and the method of indexing

P strikes the cam plate *Q*. This action releases the work spindle so that it is free to revolve. As the slide continues to travel away from the cutters, the indexing dog *R*, strikes the corresponding tooth of the indexing wheel, causing it to rotate the entire spindle one-tenth turn. Then, as the slide returns in the opposite direction, toward the cutter, the plunger pawl engages the next slot in the locking wheel, locking the spindle in position for the next cut. This motion is actuated ten times to complete a set of piston rings.

There are many features, incorporated in the design of this unit, representative of tooling principles that must be considered when automatic movements are to be used. For example, oiling of the work spindle bearings is by means of two wick-feed oilers that obtain oil from a supply located in a cored reservoir cast integral with the spindle housing. Operators are likely to overlook oilers, therefore this additional feature is embodied to insure adequate lubrication. These bearings must be snug at all times, and lack of oil would cause side or end play. With one oiling, the reservoir holds sufficient lubrication for more than 500 hours of operation. The housing for the worm gear and drum cam is made oil tight, permitting all operating parts to run in a bath of oil. Felt oil wipers are placed at the top and bottom surfaces of the slide that enter this housing to prevent oil from leaking as the slide moves in and out. Anti-friction thrust bearings take the clamping pressure of the drawbar in the work spindle, the thrust of the worm, and the pressure in both directions of the drum cam. These bearings are quite necessary in order to insure free operation. The front work-spindle bearing is tapered to permit take-up when necessary, thus giving a snug bearing fit at all times, a precaution necessary when performing milling operations of this nature.

These design features show that tooling follows closely many well-known principles of machine design. Likewise, this layout shows that some extra thought in tool design is worthy of consideration, because time-saving equipment is only made possible by careful analysis of methods, principles, and design features. This type of operation could be handled with a fixture less complicated in construction and perhaps cheaper in cost, but the output would fall short of that obtained.

■

Polishing Ford Connecting Rods

BEARINGS on the Ford crankshaft are being polished to a much finer degree as the result of the development of machines that finish all seven main and connecting-rod bearings in a single operation. Crankshafts, after final grinding and static and dynamic balancing are placed in a specially built lapping machine which has seven arms, one for each bearing. Each arm holds six, fine, lapping stones, or hones, which clamp around the bearings under heavy pressure. The shaft is rotated and oscillated until no roughness from the grinding operations remain.

To insure smooth, bright finish, the shaft is next placed in a similar machine which holds an extra fine polishing paper instead of lapping stones. Again the shaft is rotated and oscillated, after which the bearings are cleaned and inspected. The machine illustrated does final polishing of all seven bearings. The polishing paper is fed automatically so that there is a fresh supply for each crankshaft. This permits a more uniform finish than was possible under the old method.

EXECUTIVE FORUM

How Much Incentive?

THREE MONTHS before Robert L. Austin, president of the Norwalk Loom Works, had taken the advice of his friend, Bill Holland, and had appointed a committee of three to study incentive plans. The purpose was to determine the method of wage payment best suited to the needs of Norwalk's manufacturing processes. The committee was now assembled in the president's office to report its findings.

"Well, gentlemen," said Austin, opening the meeting, "I am rather anxious to hear the results of your survey. Since we decided to go in for some kind of incentive system, I have been looking forward to see one in operation in our plant. I have become convinced that some plan would be an asset to our production departments. On the other hand, I did not wish to hurry your progress, as too much care cannot be exercised in taking a step of this kind."

"We all agree with you on the value of a wage incentive," said Howard Courtney, the works manager. "Our study of the subject during the past twelve weeks has made it clear in our own minds that the adoption of a premium system would be profitable both to the company and the men in the shop. We visited a number of plants using such plans and have corresponded with a great many others. Invariably they report increased earnings for their employees and lower production costs."

"Our type of manufacture is more suited to an individual rather than a group premium," said Dan Howell, the production manager. "We have concluded that a simple system based on the Halsey plan would meet our conditions. This method allows a certain time for the completion of each job and gives the workman a percentage of the time saved by bettering the standard. When he does not improve on the time set, he is guaranteed a minimum hourly rate. On one point we have not been able to agree—that is, the percentage of the time saved for which the man should be paid."

"I advocate allowing the workman 100 per cent of the saving," said Courtney. "This provides an attractive incentive for a man to put forth his best effort. The company profits through savings in overhead which is higher than the direct labor charges. Work will flow through the shop faster, deliveries will be improved, and the effect will be an increase in plant capacity."

"Admitting the desirability of providing a wage incentive," said Hartley Nelson, the controller, "I do not feel it is desirable to give the man the full amount of the time saved to gain his co-operation. I am afraid that this amount would result in the plan's costing so much that it would defeat its own purpose. Any system of this kind involves an appreciable cost to the company. We will have to install a rate-setting department and add to our accounting force. I'd recommend fixing the workman's share at 30 per cent of the time saved on each job."

"My feeling is for a 50-50 plan," said Howell, "that pays the operator for half the time he saves. This provides a greater incentive than the percentage Mr. Nelson suggests. The company's half of the saving in direct labor should amply cover the cost of the additional clerical work involved. Compared to the 100 per cent plan, it gives the ratesetter more leeway in avoiding excessive premiums when the rate is too high. We all agree against rate cutting and some kind of a safety factor is desirable."

"There seems to be no lack of definite ideas on the subject," said Austin, "but they are all different. Each of you seem to have some basis for his views. It looks as though it were up to me to make the final decision."

■

What Do You Think About This Executive Problem?

What would be your judgment in Robert Austin's place? The committee, he has selected to decide on a premium plan, has disagreed on the percentage of the savings the operator should be paid. As president of the company, Austin must assume the responsibility for deciding an important executive policy. Probably most readers of *American Machinist* are familiar with wage incentives in some form. What has been your experience with them? Your ideas on the subject are welcomed.

. . . Discussion

of Executive Problems

■

Inspection or Discretion?

The value of an inspection executive to any organization is based primarily on his ability to exercise good judgment and carry the responsibility of his decisions, good or bad. The chief inspector, in this instance, exercised 100 per cent good judgment.

Tolerances as set up by the engineering department should be considered by an inspection department as the goal to strive for, insofar as measurements are concerned. There are, however, a thousand and one things which can happen to work in process that requires a decision on the part of the inspector. All inspectors sooner or later come to such cases "where the bolts are a thousandth undersized but when used with castellated nuts and cotter pins cannot possibly work loose." In this instance, the undersized thread did not materially decrease the utility value of the bolt, and the inspector was justified in passing the lot.

An inspection department properly organized with its line of authority and responsibility running to the general manager must always answer to the management for stock shipped improperly processed. And by the same token, the system of check and balance operates on excessive rejections by the inspectors (due to extreme exactness) by having the production personnel complain to the management. Once the design is workable and practical insofar as work in process is concerned, the above inspection set-up will take care of all variables, and the chief engineer need not concern himself with the final disposition of the product.

The inspector who rejects all work in process which does not fall within the tolerances established by the engineering department without exercising any judgment is theoretically a 100 per cent inspector. In our estimation he is zero, and the company whose inspection department is composed entirely of this class of inspectors is usually spending all of its would-be profits in reprocessing stock, that does not always need to be reprocessed, as the bolts manufactured by the Express Machine Company. —O. M. DUNTON, *Superintendent of Inspection, American Seating Company.*

Can Engineers Sell?

Besides the accepted advantage of an intimate technical knowledge of the product, the engineer has one other obvious advantage. In these days of highly specialized technical development, there are few good engineers who are born engineers—they get that way through diligent study and just plain hard work. The man who is born with a natural aptitude for selling is inclined to bank too much on his natural gift, without tempering it with the acquired asset of hard work. In almost all phases of human endeavor, a normal aptitude plus hard work will beat out shear genius.

A recent experience at the Detroit Aircraft Show seems to confirm the advantage of the engineer. A visit to the exhibit of a prominent aircraft manufacturer during the day showed little interest being displayed in the visitors, who were potential prospects. That night, however, interested groups were apparent about all the planes of that company, each under the active guidance of a representative, who was answering questions and leading the discussion. Curiosity prompted me to remark on the change to the general manager, whom I knew personally. "Yes, I've just fired three salesmen who persisted in sitting about, and put on the engineers," he replied. "The engineers have worked all day at the plant, are still going strong, and have registered the first sale of the day," he continued. And in conclusion, he advised that he was going to revamp his sales force, and rebuilt it with engineers, because they were not afraid of work and could really interest prospects. —DONALD R. WATSON.

Jigs By Whom?

A shop manufacturing light machine tools is using the following method:

The engineering drawing of a machine part is turned over to the foreman, whose department is expected to machine the part in question. He studies the drawing, and reports his suggestions to the chief draftsman next day. Sketches are desirable, but if the foreman is handicapped in this respect, he makes the suggestions orally. The explanation is made in the presence of the designer who will make the layout. The latter makes a rough sketch of the device, including his own ideas in it, and the superintendent is invited to look at it and discuss it in the presence of the chief draftsman and the designer. This method creates a spirit of co-operation between the shop and the drafting room. Both superintendent and foreman are pleased to see that their ideas are incorporated in the design. The drafting room, on the other hand, furnishes standard drawings and eliminates confusion and a duplication of effort. One of the important features of this system is that no discussions or suggestions are made without the designer.

—A. P. GWIAZDOWSKI,
University of Michigan.

Can Ideas Be Allocated?

Yes. The greater part of engineering costs can be treated as other manufacturing costs and distributed to the accounts to which they belong. But management's greatest mistake is in making a "mind" worker or creator punch a job time clock. Ideas do not come out at the ring of the clock bell like chewing gum. The best solution, I have seen, is to have the engineer turn in each night his job charges giving the approximate time devoted to each job. Accountants might object to letting the engineer keep his own job time. A thorough understanding of how engineering problems are approached and solved will quickly show the fallacy of time-clocking ideas.

Jig and fixture design should be charged against the

particular jig or fixture. Engineering work done for the sales department is charged against the particular sale; if the sale is lost, it is carried into the general overhead of the sales department. Engineering costs connected with developments of new products are charged against each new product if the product is a success; otherwise to engineering overhead and eventually going into general burden. Our later method was to charge unsuccessful developments to the departments for which the work was done, thus making the department accountable for the work, pay the bills.

By applying a carefully worked out burden on the engineer's time and making corrections each six months, after two or three years there was practically nothing in general engineering overhead not absorbed by sales, developments, fixtures, or other other definite engineering department customers or accounts. We then had a plain picture of what the engineering department was doing, for whom it was being done, and how much of each department's ideas were practical. —E. E. GAGNON.

Mechanical Superintendent, Raybestos-Manhattan, Inc.

Wholesale or Retail?

It just depends which side of the fence you are on when discussing this problem. It is one that will never be cured, and what cannot be cured must be endured. Group buying does help employees, and it does encourage them to purchase articles that perhaps would not be bought otherwise. It is not only the employees that seek to buy through this channel, but many large concerns seek this kind of business.

As one of a group of 120,000 employees, I am privileged to buy a long list of articles at reduced prices. It is not even necessary to buy through the company purchasing agent. In view of the above, how can the practice be stopped? It does work a hardship on the small dealer in many instances, and hardly seems fair to him, but those that are able to take advantage of cheaper prices are going to do it.

The question of substituting higher wages for discounts allowed on account of company connections does not enter into the subject in my particular case, because my company pays better than the average, takes better care of its employees than most concerns, and I hardly think that such a thought ever occurred to the management. —P. W. LAMSON.

Does Reciprocity Pay?

Reciprocity can pay well; it may ultimately pay neither participant. Imagine a certain firm manufacturing a standard line of petrol-driven mobile cranes. For these they must use some standard design of motor car engine. If the crane makers adapt their design of crane to suit a particular engine, they do not want to send out for fresh engine tenders every time they receive a crane order. It saves both time and money—altering design and patterns—to be able to order so many engines immediately.

If the crane makers can also induce the engine makers to give them some slight preference when they are in the market for cranes—even if it is only an opportunity to revise competitive prices—then the crane makers gain a further advantage.

The crane makers have every right to expect full market value in every engine they buy, and to be given the best possible service. When the engine makers are customers, their position is exactly the same.

All reciprocal arrangements must, in their nature, be different. Sometimes one firm is in a relatively strong bargaining position; sometimes the bargaining positions are "fifty-fifty." But, whatever the relative positions may be, only one thing can insure that the reciprocal arrangements are stable and unusually beneficial. Each must always treat his reciprocal customer as though he competed for his favor in a competitive market. Only thus can the advantages of reciprocity be reaped by both parties to the transaction, and the arrangement be a stable one. —A. W. KNIGHT,

Ipswich, England.

Inspection or Discretion?

Engineering specifications are the result of careful study and experience, and are based on the collective judgment of trained men. These men have taken the responsibility for certain thread limits, denoting a three-thousandth tolerance as the practical allowance for the shop to maintain. Any deviation from these limits should be passed on by the men responsible for them so the drawing may be corrected.

While Cary is right in saying, "Your job is to determine whether or not the finished work corresponds to the blueprint," he is not right in denying that an inspector should exercise any discretion or judgment of his own. Such problems as the permissable size and location of blow holes, and rejection of slightly defective castings require plenty of good judgment on the part of the inspector. —M. E. ROTCHY,

Planning Engineer, Celite Company.

Should Spending Be Influenced?

It is a very doubtful policy to encourage the individual employee to borrow money for the purpose of erecting a house, unless his services are regarded as being so valuable that the company is very unlikely to inform him that his services are no longer required. If he be such an individual, the company will be doing him a service in encouraging him in this way. Having once moved into his own house, he is less likely to desire to move from the district should he be offered a better job elsewhere.

A much sounder scheme, however, is for a company to encourage its employees as a whole to embark on a building scheme either in the form of a well-planned garden village, even though it consist of but a dozen small houses, or of a block of flats. I know of such schemes in America and in half a dozen European countries which have been very successful. They are of course something quite different to the much commoner garden village consisting of houses built by the company and let by them to employees at a weekly rental, in that the property is owned by and controlled by employees who have invested money in the building scheme, and the company is at most only the holder of mortgage loans. The company comes in at the beginning when it is necessary for it to get the whole building scheme mapped out so there is something quite definite to put before the employees. —H. JAMES,

Birmingham, England.

BLANK DIAMETER

B. SPECTOR
Consulting Mechanical Engineer

Fig. 1

Sheet metal blank sizes are too often determined by the cut-and-try method, which is cumbersome and costly. For eleven years, the author has watched diemakers employing antiquated practices. In this article, he gives the principles underlying blank diameter calculations with specific applications.

ALL FORMULAS for the diameter of a blank, to be used for drawing a shell of any form, are based on the equality in area of the shell before and after drawing. The equations will be true only when the thickness of the sheet metal after drawing is the same as that before drawing the principal formula (Theorem of Papus) for finding the areas of any developed surface is:

$$S = LP \qquad (1)$$

where L is the length of the line being traced on any path P. The line L moves so that its center of gravity slides along this path P, while the plane of L remains always perpendicular to the path. If the path is curved, it is assumed to curve so gradually that the successive portions of L will never intersect. This theorem has a very wide range of applications.

Fig. 1 shows a section of a round shell. This may be conceived as consisting of flanges A and B, disc C, and tubes D and E. Disc C fits into the hole of flange B, and the latter fits into the hole of flange A. Therefore, the sum of the areas of A, B and C is $\frac{1}{4}\pi d_3^2$. The area of D is $\pi d_2 h_2$; that of E is $\pi d_1 h_1$. Equating, where x is the diameter of the required blank:

$$\tfrac{1}{4}\pi x^2 = \tfrac{1}{4}\pi d_3^2 + \pi d_2 h_2 + \pi d_1 h_1$$

Multiply by $\frac{4}{\pi}$:

$$x^2 = d_3^2 + 4d_2h_2 + 4d_1h_1$$

And

$$x = \sqrt{d_3^2 + 4d_2h_2 + 4d_1h_1}$$

For example:

let $d_3 = 2.875$ in.
$d_2 = 1.75$ in.
$d_1 = 0.875$ in.
$h_1 = \frac{3}{4}$ in., and $h_2 = \frac{7}{16}$ in.

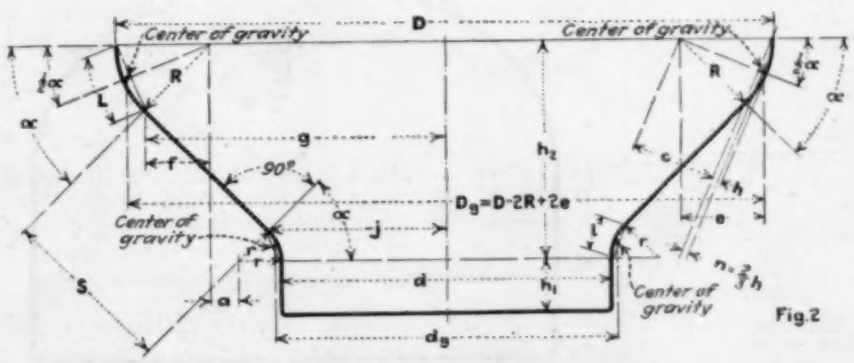


Fig. 2

$$x = \sqrt{2.875^2 + (4 \times 1.75 \times 0.4375) + (4 \times 0.875 \times 0.75)}$$

$$= \sqrt{8.26 + 3.06 + 2.62}$$

$$= 3.73 \text{ in.}$$

The calculations for irregularly shaped articles are naturally somewhat more involved, but follow the same principle. By careful analysis, most designs will be found to yield to mathematical solution. Considering, for example, the stamping shown in Fig. 2, it is first necessary to derive a formula to determine the angle α.

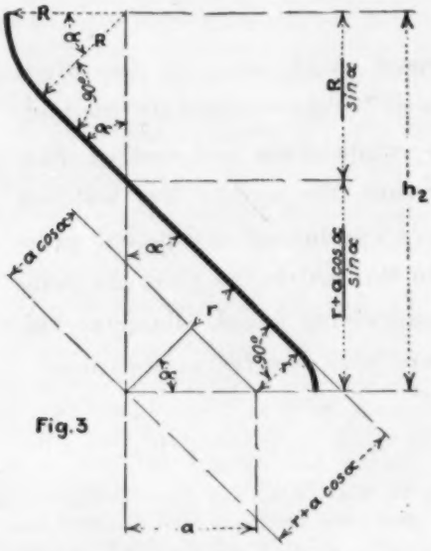


Fig. 3

Fig. 3 is an enlarged sectional view of one wall of the same piece. Then it is evident that:

$$h_2 = \frac{R}{\sin \alpha} + \frac{r + a \cos \alpha}{\sin \alpha}$$

Multiplying by $\sin \alpha$:

$$h_2 \sin \alpha = R + r + a \cos \alpha \qquad (2)$$

Since: $\sin^2 \alpha + \cos^2 \alpha = 1$

$$\sin \alpha = \sqrt{1 - \cos^2 \alpha} \qquad (3)$$

Substitute in (2) the value of $\sin \alpha$ from equation (3) and let $R + r = b$. Then:

$$h_2 \sqrt{1 - \cos^2 \alpha} = b + a \cos \alpha \qquad (4)$$

Squaring:

$$h_2^2 - h_2^2 \cos^2 \alpha = b^2 + a^2 \cos^2 \alpha + 2ab \cos \alpha$$

$$h_2^2 - b^2 = (a^2 + h_2^2) \cos^2 \alpha + 2ab \cos \alpha \qquad (5)$$

Equation (4) is of the same form as, $ax^2 + bx = c$

$$\text{wherein} \quad x = \frac{-b \pm \sqrt{b^2 + 4ac}}{2a}$$

Taking $\cos \alpha$ in equation (4) as the value of x and solving:

$$\cos \alpha = \frac{-2ab \pm \sqrt{4a^2b^2 + 4(h_2^2 - b^2)(a^2 + h_2^2)}}{2(a^2 + h_2^2)}$$

$$= \frac{-2ab \pm 2\sqrt{a^2b^2 + a^2h_2^2 - a^2b^2 + h_2^4 - b^2h_2^2}}{2(a^2 + h_2^2)}$$

$$= \frac{-ab \pm \sqrt{h_2^2(a^2 + h_2^2 - b^2)}}{a^2 + h_2^2}$$

Therefore

$$\cos \alpha = \frac{-ab \pm h_2\sqrt{a^2 + h_2^2 - b^2}}{a^2 + h_2^2} \qquad (6)$$

For purposes of illustration, assume the values: $R = 0.75$ in.; $r = 0.5$ in.; $a = 0.2$ in.; $h_1 = 0.46$ in.; $h_2 = 1.94$ in.; $D = 5$ in.; and $d = 2.15$ in. Then:

$$\cos \alpha = \frac{-0.25 + 1.94\sqrt{2.248}}{0.04 + 3.77}$$

$$= \frac{2.65}{3.81} = 0.696$$

$$\alpha = 45° 54'$$

Again referring to Fig. 2:

$$\text{Arc } L = 2\pi R \frac{\alpha}{360} = 1.5\pi \frac{45.9}{360} = 0.6 \text{ in.}$$

$$\text{Arc } l = 2\pi r \frac{\alpha}{360} = \pi \frac{45.9}{360} = 0.4 \text{ in.}$$

$$c = R \cos \frac{\alpha}{2} = 0.75 \times 0.9189 = 0.687$$

$$h = R - c \text{ and } n = \frac{2}{3} \alpha$$

$$e = (n + c) \cos \frac{\alpha}{2} = 0.729 \times 0.9189 = 0.67$$

$$D_g = D - 2R + 2e = 5 - 1.5 + 1.34 = 4.84 \text{ in.}$$

Applying formula (1), the area of the curved surface is:

$$\pi D_g L = \pi 4.84 \times 0.6 = 9.12 \text{ sq.in.} \qquad (7)$$

Computing the surface between the two radii:

$$f = R \cos \alpha = 0.75 \times 0.696 = 0.522 \text{ in.}$$

$$g = \frac{D}{2} - R + f = 2.272 \text{ in.}$$

In like manner, j is found to be 1.225 and, by trigonometry, S may be computed as 1.46 in. The area of the frustum of this cone is:

$$\pi S(g + j) = 16.05 \text{ sq.in.} \qquad (8)$$

The area of the lower radial surface is found in a similar manner to be:

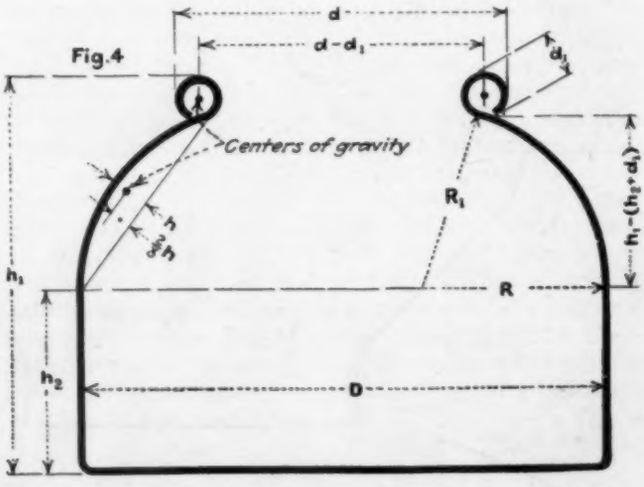
$$\pi d_g l = \pi 2.28 \times 0.4 = 2.863 \text{ sq.in.} \qquad (9)$$

The remaining surface of the piece is a cup having an area of:

$$\pi \frac{d^2}{4} + \pi d h_1$$

$$= \pi \left(\frac{4.62}{4} + 2.15 \times 0.46 \right) = 6.75 \text{ sq.in.} \qquad (10)$$

The required blank diameter x is found by the equation:



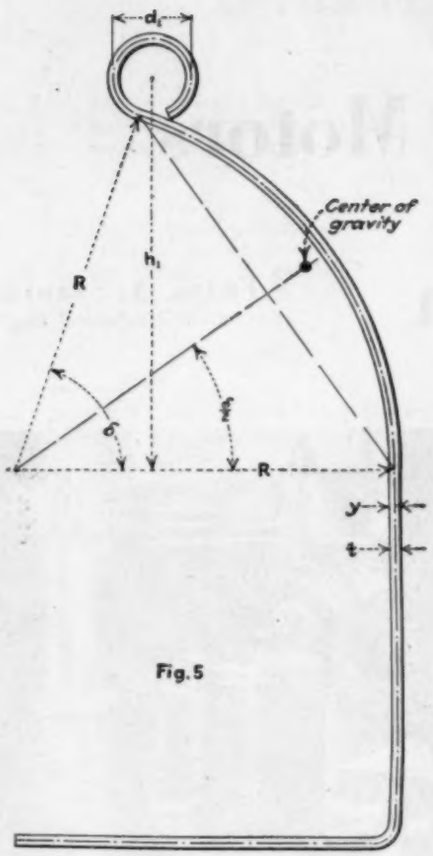


Fig. 5

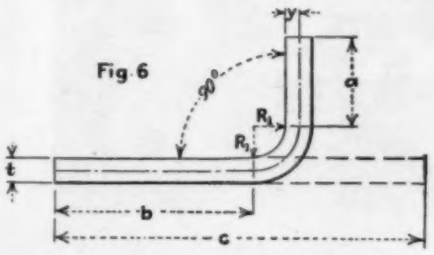


Fig. 6

$$\frac{\pi x^2}{4} = (7) + (8) + (9) + (10)$$

$$= 9.12 + 16.05 + 2.86 + 6.75 = 34.78$$

$$x = \sqrt{\frac{4 \times 34.78}{\pi}} = 6.65 \text{ in.}$$

One more example will illustrate a somewhat different problem. Fig. 4 shows a section of a tea kettle consisting of a "wire" ring, a radial surface, and a cup. The developed surface of the "wire" ring is:

$$\pi d_1 \times \pi(d - d_1) = \pi^2(dd_1 - d_1^2)$$

Referring to Fig. 5:

$$\delta = \sin^{-1} \frac{h_1}{R + \frac{d_1}{2}}$$

The area of the radial section is found by the procedure employed in the preceding example. Then the required diameter x will be found by solution of the equation,

$$\frac{\pi x^2}{4} = \text{areas of ring, radial surface, and cup}$$

In Figs. 4 and 5, y is taken between $\frac{1}{3}$ to $\frac{1}{2}$ t. If the exact value of y for a given material is required, make a 90 deg. bend in a bar of that material of the length c (Fig. 6), and take micrometer measurements of a, b, and R_1. Then the neutral (dotted) line after bending is equal to the length of the bar before bending. Or:

$$a + b + \frac{\pi}{2}(R_1 + y) = c$$

$$y = 2\,\frac{c - a - b}{\pi} - R_1$$

For example, let $a = 0.75$; $b = 1.25$; $c = 3$; $R_1 = 0.593$ and $t = 0.125$. Then,

$$y = 2\,\frac{3 - 0.75 - 1.25}{\pi} - 0.593 = 0.044$$

and $\frac{y}{t} = \frac{0.044}{0.125}$

$$y = 0.352t$$

This ratio may then be applied to various thicknesses of the same material.

The examples chosen show that the diemakers problems are capable of sound engineering solution and need not remain under the rule of thumb. There seems to be no good reason why computations such as shown for blank diameter, should not find a far wider application.

■

Scheduling Potential Orders

GEORGE H. GUNN
Draftsman, Naval Aircraft Factory

IN AN industry where time is often of as much importance as cost — for example, in the aircraft industry — the time factor must definitely be considered in estimates for the manufacture, repair, or modification of an airplane; hence, estimates are generally expected to give both cost and completion date. The manufacturer, realizing the importance of the time element in the final awarding of the contract, offers the best possible delivery date.

Of the many jobs on which he estimates, he realizes that he can get but a small percentage, and with this factor in mind, he is often tempted to give the best possible time on each job. But there is the ever-present danger that he will be awarded several contracts, all of which would have to run through the shop at the same time, and while he may be able to increase his force somewhat, he is quite likely to run into congestion in his engineering and planning department and be delayed in the procurement of materials.

One manufacturer solves this problem nicely by adding to the individual schedules maintained in each department of his plant, for the producing members of that department, entries in red showing just what men will work on the proposed job, and when, if the contract is obtained. In submitting his estimates, he always makes his delivery dates contingent upon receiving the order on or before a certain date. If the order is not received within one week after this date, it is automatically removed from the man-schedules. If it is received in time, the schedule entries are merely converted from red to black, indicating that they refer to an accepted order.

Thus, when he has too many estimates out, his schedules give him warning, and he can either extend his estimated delivery date on new estimates, or better yet, find out through telephone or mail if outstanding estimates are still open and unawarded. By the use of this simple system, embarrassing situations are avoided.

Building Airplane Motors in California

FRANK A. STANLEY
Consulting Mechanical Engineer

AVIATION development in California naturally led to the establishment of plants for building both planes and engines in that section. In one of these plants, at Glendale, just outside of Los Angeles, the Kinner engine is made; and it is with some of the operations involved in its making that this article is concerned. The Kinner is a five cylinder, radial, air-cooled, four-cycle engine. There are three sizes, known as K5, B5, and C5 of respectively 100, 125, and 190 hp. While most of the photographs shown here illustrate methods and operations in connection with the K5 motor, similar equipment and processes are employed for the other sizes as well.

This engine has a bore of 4¼ in., a stroke of 5¼ in. It develops a maximum of 115 hp. with 1,900 r.p.m. at sea level. The motor weighs 280 lb. when dry, without a starter. Its compression ratio is 5 to 1; its displacement 372 cu.in. Diameter over all is 43 inches.

The cylinder of this motor is a forged steel barrel with a head of aluminum alloy bolted on. Steel forgings come to the machine shop rough machined with ⅛ in. of metal left both outside and in for finishing. The first machining operation is boring and turning on a Potter & Johnson semi-automatic, the bore being roughed and finished to within 0.012 to 0.015 in. allowance for grinding. Boring and turning are done at 29 r.p.m. for roughing cut, feed being 0.057 in. per revolution. The finish cut is at 128 r.p.m., and the feed 0.022 in. per revolution. The cylinder goes from the semi-automatic to another lathe for turning the outsides of the flange and neck.

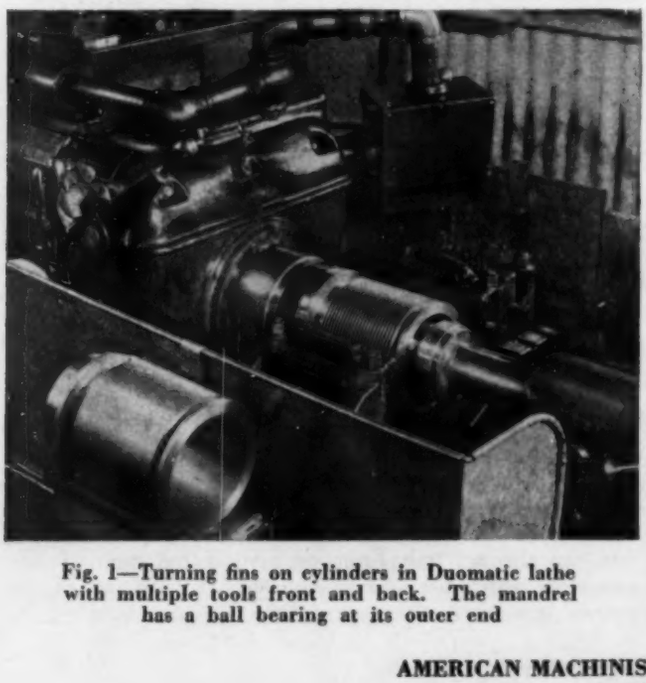


Fig. 1—Turning fins on cylinders in Duomatic lathe with multiple tools front and back. The mandrel has a ball bearing at its outer end

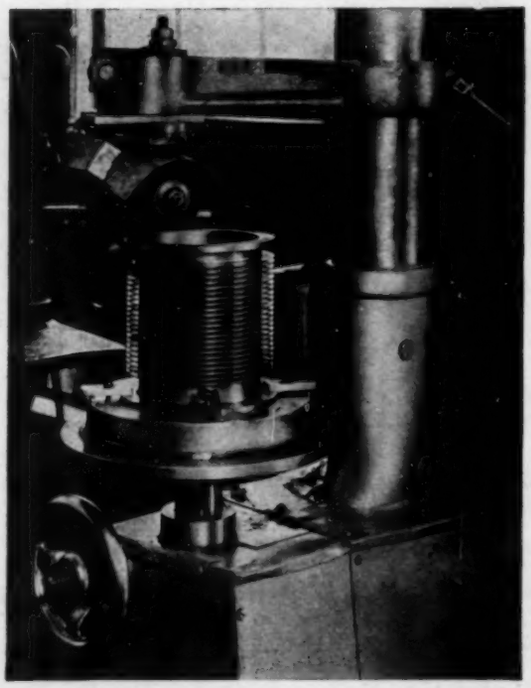


Fig. 2—Grinding the upper flange to receive the aluminum head. The grinder is made from an inverted drill press

Cylinder fins are cut on a Lodge & Shipley Duomatic, as in Fig. 1. Roughing tools are carried at the rear of the work, finishing tools in front. A special expanding mandrel with a ball bearing at the outer end holds the forging. The work is run at 28 r.p.m., with the tools fed in about 0.004 in. per revolution. Roughing tools leave 0.020 in. on each side for the finish tools to remove, in order to insure that the latter cut smoothly without sliding off the cut, or dragging. It is the practice here to grind these fin-cutting tools every fifty cylinders whether or not the tools show a tendency towards dullness, for the reason that this amount of work is clearly within the cutting life of the tools between grindings. Repeated examinations of the numerous cutting edges have demonstrated that uniformly good condition of all tools is maintained with a reasonable margin of safety through the period referred to. This course is obviously preferable to stretching out the periods between grindings to a point where one or more cutting edges may become dull and incur the possibility of inaccurate surfaces.

After repeated experiments with different cutting oils

Fig. 4—Details of the method of turning a radius in the cylinder head

Fig. 5—Cross section of cylinder head showing the radius to be turned

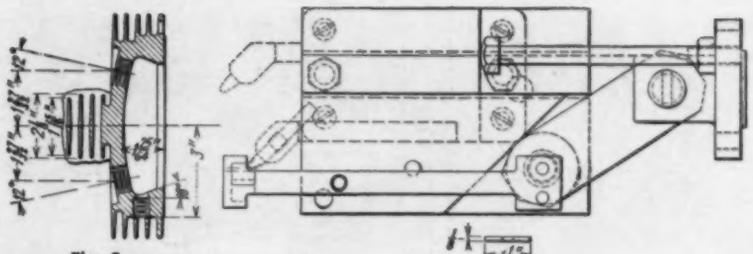


Fig. 5

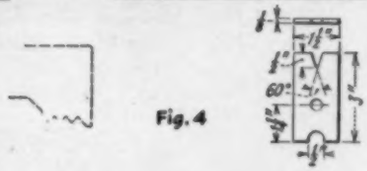
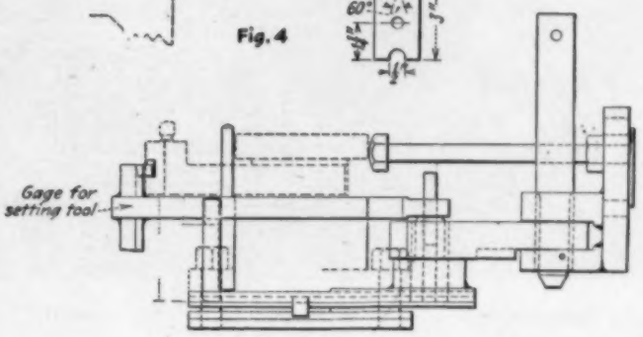


Fig. 4



and compounds, a mixture was selected that has increased the life of the tools a little over three to one. For example, the cutting lubricant formerly used gave a maximum of 17 cylinders per tool grind, while the new mixture enabled the tool life to be set at 50 cylinders per grind. The distributing head at the end of the piping shows how the work is kept flooded during the cut.

The grinding operation in these cylinders produces a remarkably accurate and finely finished surface. In this work the cylinder is rotated at 85 r.p.m. A "72-36 K" Bay State wheel, 3¼ in. in diameter, is used, the speed being 5,000 r.p.m. Rough grinding cuts are taken at the rate of 12 sec. for the 8-in. depth of bore. The finishing passes are made at the rate of 20 sec. for the 8-in. travel.

An unusual grinding operation is shown in Fig. 2. It is used in finishing the head flange for the copper gasket. The grinding is done in a circular path around the head joint so that gas will not leak. The rotary table of this grinder is driven from the drill spindle beneath. A Dumore portable grinder is attached to an adjustable

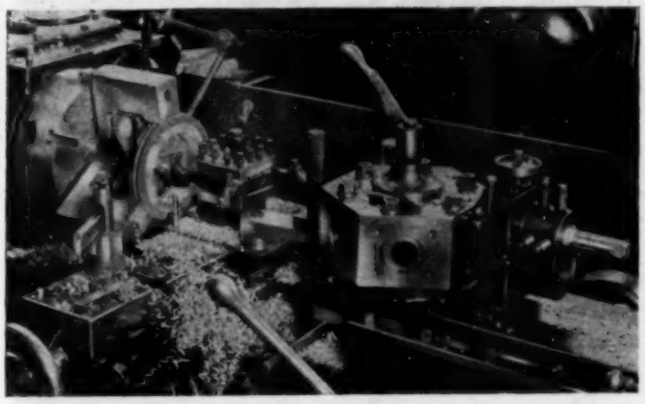


Fig. 3—Turning radius in aluminum cylinder head with special tool control

bracket for mounting upon the original table support, which is here seen upside down upon its column. The rotary table is equipped with a special locating adaptor and convenient clamps for the work.

Illustrations given in Figs. 3 and 4 show turret tools for machining the radius in the head chamber. This chamber is indicated in detail in Fig. 5.

Tools and methods are brought out clearly in the first two views. The principle consists in control of the tool path by means of a link connecting the carriage cross slide with the turret slide. With the latter clamped in place and the carriage free to travel laterally, feeding the cross slide in or out produces an arc with the tool point.

The tool is set on the center line of the spindle, a position which is arrived at easily with the aid of the gage shown, in the drawing, at the front of the tool slide. This gage is located by pins on the tool slide. It will also be noted that the boring tool at the back of the turret has a micrometer cross-feed screw. The drawing shows the two positions of the turning tool at the start and at the end of the radius cut. The toolholder and tools are both shown in dotted lines. The setting gage is reversible, having faces for both roughing and finishing tools. Special chuck jaws permit quick handling of the head between operations.

FIG. 6 shows a trunnion jig for drilling and reaming rear crankcase covers under a short arm radial. One of the drilled covers is shown in the foreground. The trunnion type fixture enables work to be loaded and removed with minimum loss of time. Suitable means are provided for locating and securing the casting in position and quick change tools and slip bushings are used. After the holes are rough drilled, a three-lip drill is used leaving 0.020 in. for reaming, which is accomplished with a step or two-size tool. The leading end takes the hole to within 0.002 in., then the main body of the reamer produces the finish size. Line reaming is allowed for in certain of the holes.

The tappet guide, which is also an aluminum alloy casting, is shown in Fig. 7. The jig for drilling and reaming this member is illustrated in Fig. 8. The two guide holes through this part must be parallel with each other as well as accurate in size. Center distance between the holes is held to 0.001 in. The wall between the holes is very light, and the work presents some interesting features in the line of an accurate production job.

The jig bushing carrier is arranged to index through 180 deg., locating the two holes at equal distances from the common axis. Slip bushings are used for drill and reamer. A detail of index and clamp is shown at *A*, Fig. 8. The work itself is located in V's and is secured

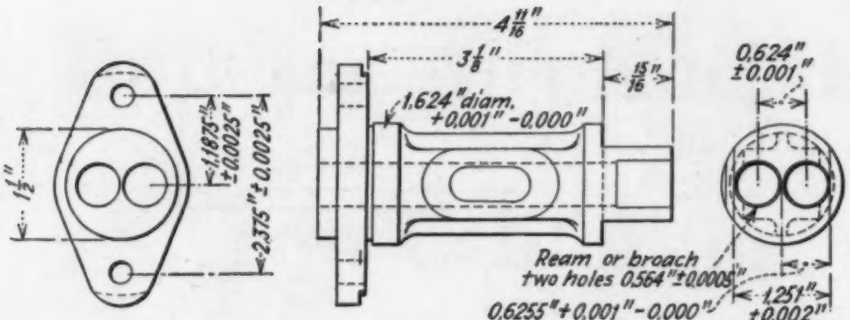


Fig. 7 — Valve tappet guide with parallel holes

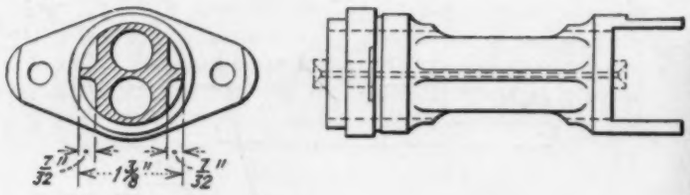
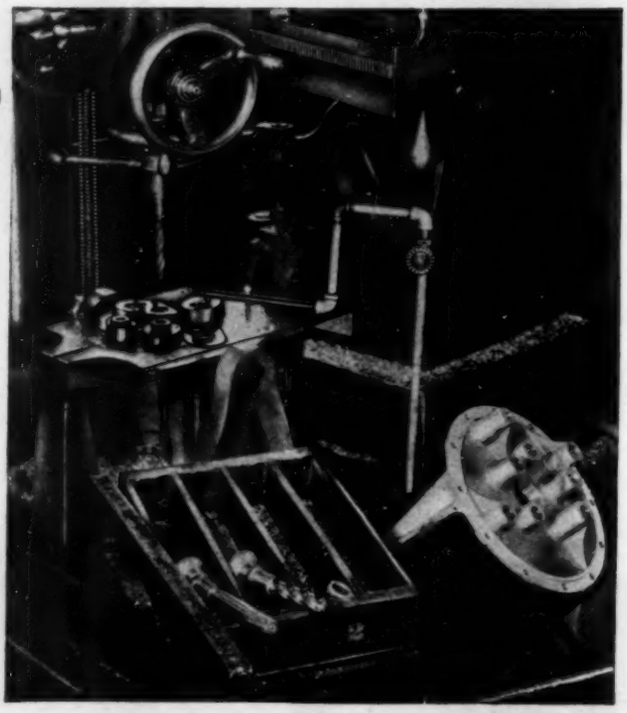


Fig. 6—Trunnion fixture for drilling rear crankcase cover



by a cam-controlled locking plunger. All the essential details are included in the illustration.

Although this may seem like a simple job, the accuracy required makes it a real problem in machining, and great care is necessary in making the drilling fixture used. The thin wall between the holes increases the tendency of the drills to run unless they are kept sharp. A drill with a dull cutting edge is much more likely to crowd the side that has so much less resistance. Then too, the length of the holes, as compared to their diameter, is a factor to be considered.

This job was originally done by boring, the tapped guide being carried in a chuck that was indexed from one position to the other. In addition to being more costly, this boring method did not prove as satisfactory as the drilling method. The locking clamp, shown separately at *A*, and in position at *AA*, locates the bushing plate in the correct position for drilling the holes, while the work is firmly held by the cam-

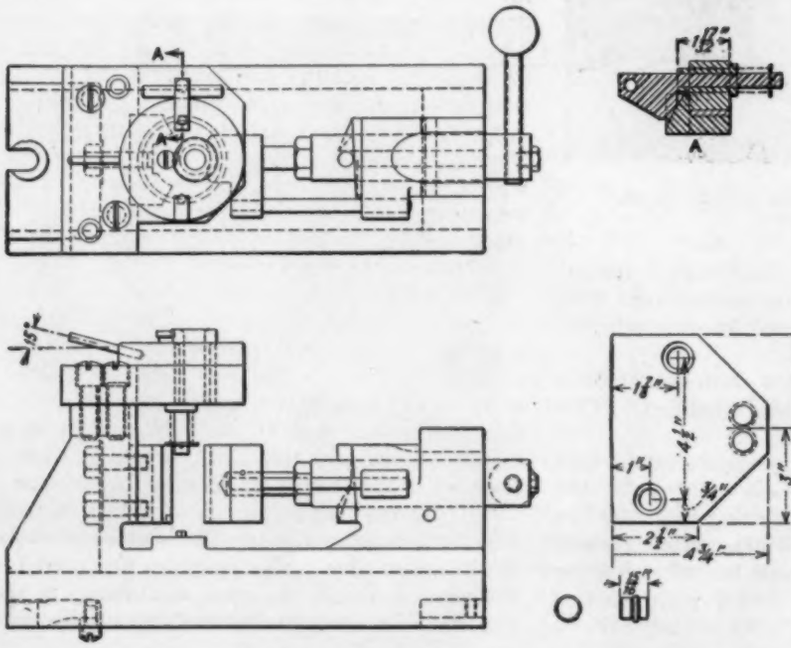


Fig. 8—Details of fixture for drilling and reaming valve tappet guide

Fig. 9—Unusual assembling stands used for the Kinner shop

controlled clamp, as indicated.

Operations of this kind, where extreme accuracy must be maintained to insure the safe and proper operation of the engine, add materially to the cost of manufacture. The comparatively small output makes the cost of fixtures an important item, since the outlay for tools cannot be distributed over a large production.

An unusual type of assembling stand is seen in Fig. 9, one of the C-5, 190-hp. engines showing in the foreground. While this is a trunnion fixture, the frame is angular and not symmetrical with the trunnions. It has been designed to give ready access to the engine and to hold it at a convenient height.

In view of the increasing importance of airplane engines a schedule of the fits and clearances found best for this class of work will be both interesting and valuable. These refer particularly to the K5 engine of 100 hp. but do not differ materially in the larger engines.

Summary of Fits and Clearances of Kinner K5 Engine

Parts	Minimum	Desired	Maximum	Replace
Camshafts diametrical clearance in boss	.003	.0035	.004	.007
Camshaft end play	.010	.015	.020	.025
Crankshaft diametrical clearance, main bearings	.00175		.002	.003
Crankshaft end play	.010	.012	.014	.025
Master rod bearings on crank pin	.0018	.002	.0022	.004
Master rod end play on crank pin	.008	.010	.012	.020
Magneto drive shaft diametrical clearance	.003	.0035	.004	.007
Magneto shaft end play	.011	.015	.020	.030
Oil pump drive shaft diametrical clearance in body / Oil pump drive shaft diametrical clearance in cover	.0015	.002	.003	.004
Oil pump gears diametrical clearance in body	.001	.003	.005	.006
Oil pump gears end play	.001	.002	.0035	.005
Oil pump gears diametrical on idler shaft	.0012	.0015	.0027	.004
Piston ring gap	.012	.012	.015	.025
Piston ring in groove No. 1 top (side play)	.003	.0035	.004	.006
Piston ring in groove No. 2 (side play)	.002	.0025	.0025	.005
Piston ring in groove No. 3 (side play)	.002	.002	.0025	.004
Piston ring in groove No. 4 Oil scavenger (side play)	.001	.0015	.002	.004
Piston pin in piston	Push fit at 68° F.			.002
Piston in cylinder on skirt	.020		.025	.030
Piston in cylinder at top	.0345		.0375	.043
Piston in cylinder	Replace if over .005 out of round.			
Key fit in hub	Fit	.001L	.002L	.003L
Key fit in shaft	Light press fit.			
Link rod on lock pins forced feed	.0008	.001	.0012	.0025
Link rod side play forced feed	.006	.0075	.009	.020
Link rod on piston pin	.0008	.001	.0012	.003
Link rod on lock pins splash feed	.0015	.002	.0025	.0035
Link rod side play splash feed	.012	.018	.024	
Tappet roller on axles	.0015	.0017	.002	.004
Tappet roller side play	.005	.007	.008	.012
Tappet in tappet guide	.0032	.004	.0048	.008
Rocker arm axle in bushing	.0015	.0015	.002	.006
Rocker arm side play	.010	.012	.014	.030
Valve diametrical clearance exhaust and intake	.0025	.003	.004	.010

Raising Wages Automatically

James F. Matter
Supervisor Press Shop, E. G. Budd Manufacturing Company

IN ANY shop where standard times are set for each job, it is possible to work out a fair answer to the question of raises. At the end of each week or month, the ratio between the estimated time and a man's actual time is obtained as a percentage. For example, suppose a certain operator worked on jobs the estimated time of which totaled 48 hours, and he took 60 hours to complete them. Then his efficiency is:

$$\frac{48}{60} \times 100 = 80\%$$

The same procedure is followed for the other employees who are divided into wage groups somewhat as follows:

Above 100%—Class A
90 to 100%—Class B
80 to 90%—Class C
70 to 80%—Class D
Below 70%—Class E

All men will fall down occasionally, but average figures will prevail. It will be found that the best men will always lead—and those in the lowest class should not be tolerated very long. A wage scale is established for each class. When a man increases his efficiency and enters a higher class, automatically he gives himself a raise.

The Foreman's Round Table

DOLEFUL TIMES

"SAY Al, did you notice how solemn Williams looked this morning when he came through the shop? What was it, a stiff poker game last night?"

"Nothing like that. They are going to close down the old plant in Colbyville, and it's got him worried."

"Gee, is that so? What will they do with all those old buzzards down there? About the only reason they kept the plant going was to do special work and keep those old timers going. Will they transfer them up here and lay off some of our men?"

"No, that's the tough part of it. Most of those men were born and raised in that little town, they are solid citizens of the community and command its respect. They can't be transplanted. One of the queer things about this business is the difference between a man in dirty overalls in the shop and the same man as the head of a family in his own community. I never told anyone, but I was 'pinched' for speeding in a little town and the justice of the peace was one of my own men."

"That was lucky for you, wasn't it?"

"Yes, it wasn't. I pleaded guilty and he fined me the limit without batting an eye. He never referred to it afterward—and neither did I."

"Well, anyway, that don't help those men at the old plant. How is it that a prosperous country like this can have such slack periods as we are going through now, Al?"

"There are several reasons, Ed. You might say it was due to a shortsighted policy on the part of management in over-building in prosperous times. This is usually brought about by salesmanship that promises, or by customers that demand short deliveries. The eight-hour day is also responsible. We had to increase our capacity by twenty per cent and add more men, and of course, some firms took advantage of the fact to increase still further. Management usually plans for maximum output and forgets the possible minimum."

"It looks like they forget the working man, too. I heard a man say that if married women whose husbands are also working were fired, we would have a shortage of labor."

"That can't be helped, Ed. A woman has the same right to work as a man has, and usually they have a different kind of job."

"Sure, in busy times. But when it's dull it isn't fair for several members of one family to be working and no members of another. That don't affect us, though. What does Williams propose to do in our own case?"

"It isn't up to him. It's a matter for the board to decide. I heard they were discussing the policy of some big rubber company that allowed the old employees it laid off one week's pay for every year they had worked for the company. But that would be a heavy tax on the business, in this case."

"I'll say so! Why not retire them on full pay and save part of it?"

Whether or not we agree with Al and Ed as to the causes of unemployment, we are interested in its prevention. We have solved more difficult economic problems than unemployment. Aside from the dole, what is the remedy?

Suggested by Chas. E. Kirkbride, Jr.
Naval Aircraft Factory

▸ ▸ ▸ Discussion of Former Topics

Boss, or Advisor?

An executive should not be just a boss, he should be an advisor and a leader. My advice to any young man just starting in as head of a department, be it large or small, is that he should first study his job and then his men, because he must be thoroughly familiar with his job to be able to tell someone else how to do the several things necessary to produce best results. I also advise a young man not to take himself too seriously, because he will never be too old to learn and he may have some one under his supervision who knows as much or more about the job, but who has not the ability to be a leader. This is where the "Boss" gets his greatest help. Win the confidence of your men and the job is half done.

Always remember that a foreman is the link between the higher officials and the journeyman. No matter how he gets his orders from the front office he should use common sense in passing them along. By this I mean that if the front office sees fit to get rather rough, it is no reason for the foreman to pass it along that way. He may be at fault himself. Don't be rough—be yourself, and, as Andy says, "Use psyrology."

—S. H. Foote, *Chief Inspector, N. Y. Airbrake Company.*

Playing Favorites

When a man is hired and put to work he sells his time and experience according to an approved standard. For every hour he labors he receives a certain amount of pay, and regardless of the kind of work, as long as it is in his line, he has no right to complain. If, as sometimes happens, a workman is by nature a grumbler, the foreman should be deaf to his grumblings and continue to run the shop as his best judgment dictates.

A successful foreman always studies his men in order that he may place them on work at which they are the most efficient. He finds no two machinists with the same qualifications. One may be slow, exceptionally exact, and the clever foreman will find himself giving this man the fine light work. Another will be naturally coarse and rough, better suited to the odd and heavy job.

As for favoritism, let us have more of it. For what is it when analyzed? Nothing more than giving the best you have according to your experience, scheduling your work with a fair, unbiased mind, regardless of comment. Nature endows each workman with many different attributes peculiar to his own personality. The foreman is alert to this and links these different qualities of every day living with his work. To the man who is neat and clean both in and out of the shop, goes the kind of work you would naturally associate with this man; while the slack and untidy man might wallow in the greasy job with more comfortable ease. Favoritism has a justifiable foundation which, like most foundations, may be hidden from view. When you find an individual complaining of his lot you can make up your mind he is receiving exactly what he deserves.

—Rockwood T. Roberts, *Boston & Albany R.R., Worcester, Mass.*

Quality or Quantity?

It seems to me quite a pity that "fur" was allowed to fly in Ed's section when such a problem as the value of apprentices was discussed. It should be remembered that there was a time when we foremen were apprentices and that, good, bad, and indifferent as we were, we depended upon our respective foremen to give us opportunity to show what we could do. All boys are not alike. Some are blessed with an aptitude, some are not; and it is my opinion that we, as foremen, should go as far as time will permit in helping the inept ones.

As a foreman with at least half a century's experience, I can look back to many instances when I have taken care of backward boys. Some of them have later become an asset to me.

—J. T. Towlson, *London, England.*

Honest Graft

Are executives justified in asking employees to work extra hours without overtime pay? Dare to try it in any plant! The effect on shop morale would be disastrous. If a mechanic will not work overtime without compensation, why ask minor shop executives to attend overtime conferences without payment?

My experience is that a man is compelled to work harder in order to take an intelligent part in a conference than he must in carrying out his regular routine. Yet some plant executives feel that no payment should be given for the use of a man's time and brain at a conference. These men feel that a promise of promotion in the future is sufficient return on the investment which they compel their subordinates to make. An investment that means, not money, but time taken from recreation which a man needs in order to give his best on the following day.

Regarding the question on ethics in a workman's asking for payment for these conferences, I think that the ethics of the man who refuses to pay full overtime for the time taken up by a conference are exceedingly bad. A person who gets something of value, and who gives something valueless, such as promises of promotion, is far from ethical. After all, promotion is limited to a comparatively small number of people. Therefore, the individual cannot be sure of promotion, while overtime money never disappoints its possessor.

—W. C. Bartholomay, II.

Ethics of Making a Change

Last October a friend of mine changed his location from one large corporation to another. Shortly after this he was offered a far better position. He spoke to the G.M. and was talked to for three hours. The conversation was all indefinite. No promises were given outright. The other company gave a definite contract, and it was accepted. The next day the G.M. called to see the man at 10 a.m., and talked for a short time. He

was told that the original notice would hold, and that the man would like his time at noon the next day. At 11 a.m. his time check was handed to him, and he was told to have his tools out of the shop at noon. He was not paid up to noon on Saturday, but until noon of that day, Friday.

A beautiful way to treat an engineer. Will it leave a bad taste in his mouth? Certainly, and not only in his mouth, but in the mouth of every employee of that plant.

A man intending to leave a plant is a fool to talk it over with an official until he is through.

—C. G. WILLIAMS.

Experience or Authority?

Regardless of experience, to a large extent the work of a subordinate is defined and detailed for him. He has comparatively little option and a limited responsibility. A faithful performance of routine duty is the main thing, perhaps all, that is expected of him. If he is bright and ambitious he may find opportunities to suggest improvements; but the responsibility for accepting or rejecting these suggestions is the work of the party in authority.

As soon as a shop outgrows its first environment, the question of who shall make repairs begins to make itself prominent. When the factory has reached the continuous production size, there is only one answer: that is, to have a repair department and let no one else make repairs. Between the two stages there is a great deal of room for argument, and the decision in each particular case is not easy to find.

Shops that employ highly skilled men for practically all of their production work cannot refuse such men the privilege of making their own repairs and adjustments. It is cheaper to have them make them than to have a repair gang, because a repair gang could not do the work so well, nor so quickly. However, as soon as operators who are not skilled mechanics begin to come into the shop, with them must come the repair gang.

—GEORGE S. GOODRICH.

High Rates

No one ever heard of a runner being awarded a prize before a race was run. Pennants go to ball clubs after successful seasons, and loving cups go to the golfers with the lowest scores. Raises, like everything else, go to the men who have earned them.

Many foremen, and most men, go through life without properly understanding the wage question. Wages are governed by the standard paid in any district, and this standard is controlled by the replacement value of the men. The tendency of most employers is to strive to secure a higher type of men and to pay them the last cent they are worth.

In any case it is a good policy to pay several of the top-notcher men a higher rate than the average top rate in the district. This provides a real example of the fact that merit will be rewarded. On the other hand, few employers would make successes of their plants if they granted wholesale raises in the hope that higher standards of quantity or quality of production would result.

—JAMES K. MATTER, *Supervisor, E. G. Budd Manufacturing Company.*

From Soup to Nuts

A man may be ever so good a mechanic, but unless he is a mixer and can meet the public he will always remain just a good mechanic. The social contacts a man makes are very important. You can learn to meet the public in only one way, by mingling with your fellow men. Doing this you acquire that polish and poise which will enable you to meet any situation. You unconsciously acquire the grace of making a good appearance. In almost every case the first impressions are the most lasting. The best way for self-advertisement is to mingle unobtrusively with others. People will become acquainted with you, and your abilities will become more widely known. Many times a man's true worth is overlooked by even his immediate superiors until someone else makes it known. A wide social acquaintance often brings about this happy event. —L. O. BROWN, *Toolroom Foreman, Holcomb and Hoke Manufacturing Company.*

Quality or Quantity?

Apprentices should never be segregated, for they acquire knowledge from experienced mechanics. At intervals they should be shifted from one part of the plant to another, usually beginning as helpers in the assembly division, and gradually working from the operation of one machine to another. However, any technical training which a plant management desires to give can be supplied by a particular instructor, apart from the actual work itself. Unless a boy has special technical training in drawing and working from blue prints, it seems unlikely that he can acquire it by associating with machinists.

Some shop foremen are too nervous or overworked to be bothered with the apprentices, but it will be of much advantage to the latter to appoint someone who has the knowledge and time for instruction.

It is hardly possible to name any certain time, in a normal apprenticeship, when one can definitely state that a boy should acquire speed. Some never do, even long after they have become finished mechanics. Yet I have seen boys in their third year turn out a fine day's work.

At present nothing is more important to the future of the machine trade and to the whole metal manufacturing industry itself, than a carefully arranged schedule which will induce young men to take up the business and stick to it. —RAYMOND H. DAUTERICH.

The Spring Song

The desire for an increase is so much a part of the makeup of every man (except poets and some millionaires) that it may well be regarded as a state of mind. It is equally true that the call of spring makes the average man more dissatisfied with the monotony of a regular job and with a biologically unnatural manner of life than at other times during the year. It is simply a sign that he is a real human being. He is less concerned about risks and therefore more outspoken with his demands. If he is not, it is a sign of either ambitionless respectability or the beginning of mental decay. It is true that in spring a man is more likely to throw up a job because he thinks he is not being fairly treated than at any other time in the year, but generally he will do it because he can get more somewhere else.

—H. J. BURNHAM, *Birmingham, England.*

BEHIND THE SCENES

In Continental Europe

Still under the protection of his anonymity, the author continues and concludes the discourse begun last week. That France will be forced to be a major purchaser of new industrial machinery and equipment is just one of his pronouncements

AS YOU go down the list of French credits in this ledger page showing transactions between France and the United States, this, very briefly, is what you find:

French sales of goods to us	$131,000,000
Freight that we pay them for hauling our goods	10,000,000
Immigrant remittances from here to France	3,000,000
Passenger fares paid on French liners by Americans	10,000,000
Smuggled goods	5,000,000
American Tourist expenditures in France	215,000,000
Interest Paid to France on investments in this country	58,000,000

These investments probably total a little less than one billion dollars at this time, split about equally between long- and short-term obligations.

Miscellaneous collected over here on odds and ends (such as royalties on French films) about $1,000,000.

That makes their credit total about $433,000,000

As against that, we have:

American sales to France amounting to	219,000,000
War debt of France to U. S.	32,000,000

You notice this is about ⅛ of our tourist expenditures in France. Prof. Rappard of University of Geneva wasn't far off when he said that the Americans seemed to be a charitable people, that our hard-hearted bankers and government officials lend them huge sums at high rates of interest; then we send our wives and daughters over to pay all those charges.

The freight that the French pay us is about $2,000,000, passenger fares perhaps another million.

Interest on American investments in France due us	$47,000,000
Miscellaneous, such as film royalties and bunker fuel and things like that, about	9,000,000

Total of credit for the United States, $311,000,000; total credit for France, $433,000,000. The net balance payable to France, $122,000,000 on those exchanges, liquidated by exchanges of gold and in one or two other lesser and more specialized manners.

Now there is no excuse for well-informed Americans to ignore these facts. This thing is well known, has been frequently announced; yet many of them have deliberately swallowed whole the proposition that an international balance is confined to interchanges of merchandise, which is no more true than it is between individuals.

Tariff

As to the increases in the present tariff, it is worth noting what the new tariff implies in connection with the major items—just four or five major items of French exports to this country, which comprise about one-third of the total French trade. There has not been a perfectly devastating and volcanic upheaval in increases of rates, anywhere near comparable to the upheaval of vituperative verbiage. One would assume, from what has been said, that these schedules have been piled sky high, and that they have been at least doubled, or if not doubled, then certainly increased by half or a third, or something like that—instead of an average increase of about 2 per cent. No one can tell me that that microscopic increase is going to have the desolating effect that is ascribed to the tariff, one way or the other. Remember, also, many of the other items. I have not had the opportunity or time to go through the whole schedule, but with respect to many of the others I have not touched upon, such as perfume, precious stones, pearls, china, millinery, furs, and things like that, the general trend of increase is just about under the same ratio but many of these, including those that I have just mentioned, are luxuries which are going to be brought into this country no matter what the price may be—within reason—if, as, and when (to quote our insurance friends) the level of living standards in this country and the prosperity of the country permit. Tariff has relatively little to do with it.

I am quite convinced that those changes, or the changes in price that will be necessary because of these

very microscopic alterations in tariff, which by and large are privately very satisfactory to most of the traders involved, are not going to have the devastating effect upon our imports from France which is so frequently predicted by irresponsible commentators. As a matter of fact, at the time the Fordney Tariff Bill was adopted, European currencies were all shot to bits, only about 55 per cent of the currencies of the Continent were in a position of reasonable stability, and that was the whole argument advanced by Fordney and his group to warrant the very stiff increases that were brought on in 1922. There were wails from all corners of Europe that the American tariff was going to ruin their trade. The wails were loudest from France. It so happened that French currency was then flat on its back, not quite as bad as the German, but nearly so. Imports were correspondingly pouring in over here, and the feeling of the tariff experts was that they could impose duties to stop that thing, and they consequently slapped on good, stiff tariffs on French merchandise. The French protest was very emphatic and prolonged, the assertion being made that French trade was going to be destroyed.

What has actually happened since 1922? French exports to the United States have increased 62 per cent, and that was an increase almost entirely in volume as well as value, because the prices have not gone up, during that period, anywhere near in that proportion.

Trade Restrictions

There is another phase in this whole picture, and that is the European trade restrictions upon American commerce. The French tariff itself has 8,000 different commodities and classifications (I wish you could see what the thing itself looks like). If you were an exporter you would be confronted with an onerous job trying to find just where your commodity would be classified among those 8,000 categories, with a view toward discovering whether you've got a market over there, or what the price will be on your commodity. After you have found the proper category for your famous noiseless alarm clock, or your equally famous toothless combs, and try to discover the rate, you find that France has certain favorable treaties with Poland and Czechoslovakia which are going to favor the Czech manufacturers of the noiseless alarm clock or the Polish manufacturers of toothless combs, and that you are exactly nowhere until you have gone through the treaties between France and Poland and France and Czechoslovakia and found out just how much of a preferential (in behalf of those political Allies of France), you will be compelled to overcome.

It is true that in many cases with respect to our own tariff, we don't know exactly what's going to happen to imports in the way of rates until they have had a run through the customs house. But certainly we have not imposed that other formidable and almost impossible hurdle to those who want to conduct business—the necessity of trying to dig through a maze of enormous accumulations of politico-economic treaties. Thus we see one of the difficulties that are involved in the French tariff—the trade restrictions imposed by the French, which are numerous and very heavy.

Rivalry

As we consider the economic future of Europe, we are confronted with a problem which is more and more in evidence on the front pages of the daily press, namely the Franco-Italian rivalry. You see the evidences of Mussolini's sword-rattling of late. That Franco-Italian relationship isn't as good as it might be. Frankly we should interpret Mussolini's speeches rather liberally because they are largely delivered for domestic consumption—the politician's trick whenever things aren't going so well at home, and they haven't been going quite so well in Mussolini's backyard. A great deal of that is undoubtedly in these rather truculent speeches that Mussolini has made, but there are ominous economic rivalries between the two countries, which I think is very desirable for us to have in mind, because it affects our own markets in both places and it affects our markets in the colonial area where this conflict seems now to be brewing. I think probably that we all should agree to keep reasonably calm and keep the political exigencies of the situation moderately suppressed, but the utter inability for France and Italy to get together at the London Armament Conference is just one indication of how that kind of a situation simply leads to unrest and all too frequently leads to more serious difficulty.

Of course you have other foster relationships more or less. Albania, which you will remember is right across the Asiatic from the heel of Italy is now recognized as practically an Italian protectorate, but it is entirely surrounded by Jugo Slavia, which is very much under French influence. There you have another rivalry. Then of course following the well-known principle of European diplomacy that my next-door neighbor is my enemy but his neighbor is my friend, they just alternate—France and Italy do—in the adjacent territory. Hungary is very much a friend of Italy, and Roumania, just beyond is very pro-French. You can see how nicely a checker board the whole arrangement is, and how lovely the tinder box is set for some little friction. The minute you climb on the Albanian, or rather climb on the Jugo side by way of Albania, the French would step in and the Hungarians would come right in after them. The whole house of cards would likely come down at one time. In more ways than one the hot-tempered and more or less uncontrolled element in those countries have the makings of first-grade wars.

France

I want to call your attention to one very serious aspect of the French situation at the present time—the domestic situation. There is no unemployment, there are enormous investments abroad—more than a billion dollars in this country alone, scattered around everywhere. The tax burden is comparatively light, industries are occupied full-time, so you can imagine a very satisfactory situation. Everything would seem to be decidedly well. The question of her population in relationship to labor presents a very ominous ratio, however, and this reacts directly upon our possibilities in the sale of machinery and the rationalization of French industries. The loss of population following the war involved not simply the death of a million three hundred thousand soldiers, but there has also been a very heavy decline in the average annual birthrate, and France is just on the eve now of feeling the effects that hadn't been evident up until this year. The average births run around 750,000 a year. The average during 1915 to 1919 was 430,000 against the 750,000. Up to this year the men working in the industries, were men who had been born before the war. This year, they are beginning to get the 15-year-old apprentices who were born in that first year of the war. In other words, they are entering the twilight zone —reaping the results of this falling off in male popula-

tion this year for the first time. From now on, at least for the next five years, France is going to feel very seriously that shortage of labor in her industrial make-up. It will get more serious as they move along, and it is a thing that is very gravely concerning the French people, as well it might.

That is the only reason why they are so excited about Mussolini's ban on emigration. Ordinarily the French crops in the south of France were dependent on about a million temporary emigrants from Spain and Italy. The Italians are now being pretty well shut off. The Spaniards are coming in, but in nothing near the numbers that are necessary to carry the burden. The acquisition of Alsace-Loraine, of course helps somewhat to fill this gap, but these next five years are going to be crucial years for French industry, and, therefore, it would seem to me worth canvassing carefully the possibilities of labor-saving devices to France, in which of course, American industry holds the leadership. It is the one country, as I see it, in the whole of Europe that does offer definite prospects for varied experiments in rationalization.

Unemployment

Germany has two and one-half million unemployed; England, one million seven hundred thousand unemployed; in France none whatever. Italy has quite a number; how many no one knows. In Russia this is also an unknown number. In France, however, they need labor-saving devices, and that is going to be evident in these next five years to an unusual degree. Incidentally, one of the tragic features of it is the fact that the real cause of the difficulty is the increasing death rate, rather than a heavy decrease in the birth rate. The excess of deaths over births, two years ago was 12,500—last year it was 70,200. That might be due to either one of the two factors, but according to the French Medical Association, out of every 80,000 infant's deaths, 60,000 are due to under-nourishment. That is an appalling situation for a supposedly well-advanced country, and shows the need for very considerable improvement in sanitation, and in nutrition. Any of us who have been out in the country in France and have seen the way some of the peasants live and the excessive frugality, parsimony it really amounts to, with which their whole diet is carried on, realize the background of that appalling 60,000 infant mortality from under-nourishment. That problem is of the greatest consequence to the future of France, and it is going to modify materially her outlook in these next five years. She is not going to be anywhere near, as I view it, in the favorable position that she has been during this decided boom decade since the war. She is going to have her troubles with industry, and it would seem to me to be offering her a decidedly desirable opening for certain types of American equipment and worth certainly a very careful American study, provided we can get some co-operation from the French authorities in modifying the restrictions to which I referred previously.

The conflict between Italy and France is gradually coming out in its true light. The recent weeks quite clearly bring out the purely incidental and local character of it. Mussolini no sooner gets through making one of his speeches when the next day the Italian Foreign Minister comes around to the French Ambassador and makes a little apology and a little explanation. It is a great deal like children; they sort of develop each other's nuisance value, so to speak.

It was revealed not long ago that Grandi representing Italy at the Arms Conference in London, went to great pains to learn English. He was a perfect master of French, and with either French or English as the official language, he could just as well have given his speech in French. But he went to the trouble to learn English as a sort of jibe at his French friends and read all of his speeches in English. Little childish tricks like that are indicative of all this sort of thing. It looks like just a good Latin shoulder-shrugging and arm-waving match.

Nevertheless, if I were advising manufacturers of machinery in this country in any direction at all as to European markets, I would strongly urge careful consideration of the potentialities of France. Opportunities may not be there at the moment in very large amounts, or the French tariff may obstruct the way to a certain extent, but you can be very sure that the necessities of labor-saving devices are going to be more and more acute right from this present year.

■

The Rôle of Engineering Education

Discussion

W. Roland Needham
Stafford, England

CORNELL UNIVERSITY'S Dean of Engineering has done engineers good service by his notable contribution to the *American Machinist*, page 575, Vol. 72. The day has gone, on both sides of the Atlantic, when leading men of affairs can with some show of reasonableness argue on a practice versus theory basis. The marked advantages of a sound university training in the principles of engineering are recognized wherever responsible opinion holds sway. The time is fast approaching when such experience will be enforced as a necessary qualification for status as engineer. Like insistance will also be placed upon a thorough and intensive practical course of training under commercial auspices. This stressing of the needs and requirements of a dual experience will obtain whether the prospective engineer wishes to qualify for a commercial or a scholastic career in engineering; whether he enters the design field, the sales office, into managerial service, or embarks upon a teaching career.

Indeed, when engineering professors and teachers are men who have definitely passed through the manufacturing mill, they will be better qualified to instil the commercial viewpoint. Engineering design, for instance, differs from those courses taught by the man who is purely a theorist. Laboratory work, too, and workshop training, where such is incorporated in the curriculum, receive that indefinable touch with the realities of industrial conditions which only those can impart who have themselves undergone that vital experience.

The writer is convinced that there should be more effective collaboration between college and industry. It is all to the good that at least part of the vacations should be spent in obtaining first-hand experience of working conditions in temporary industrial employ In Scotland and the North of England, the "sandwich" system, whereby college terms and works' experience are dovetailed, finds increasing favor. There can be no doubt that it does tend to impart that touch of reality which enables a student to appreciate theory all the better because he understands the practical implications also.

AMERICAN MACHINIST 1930 INVENTORY

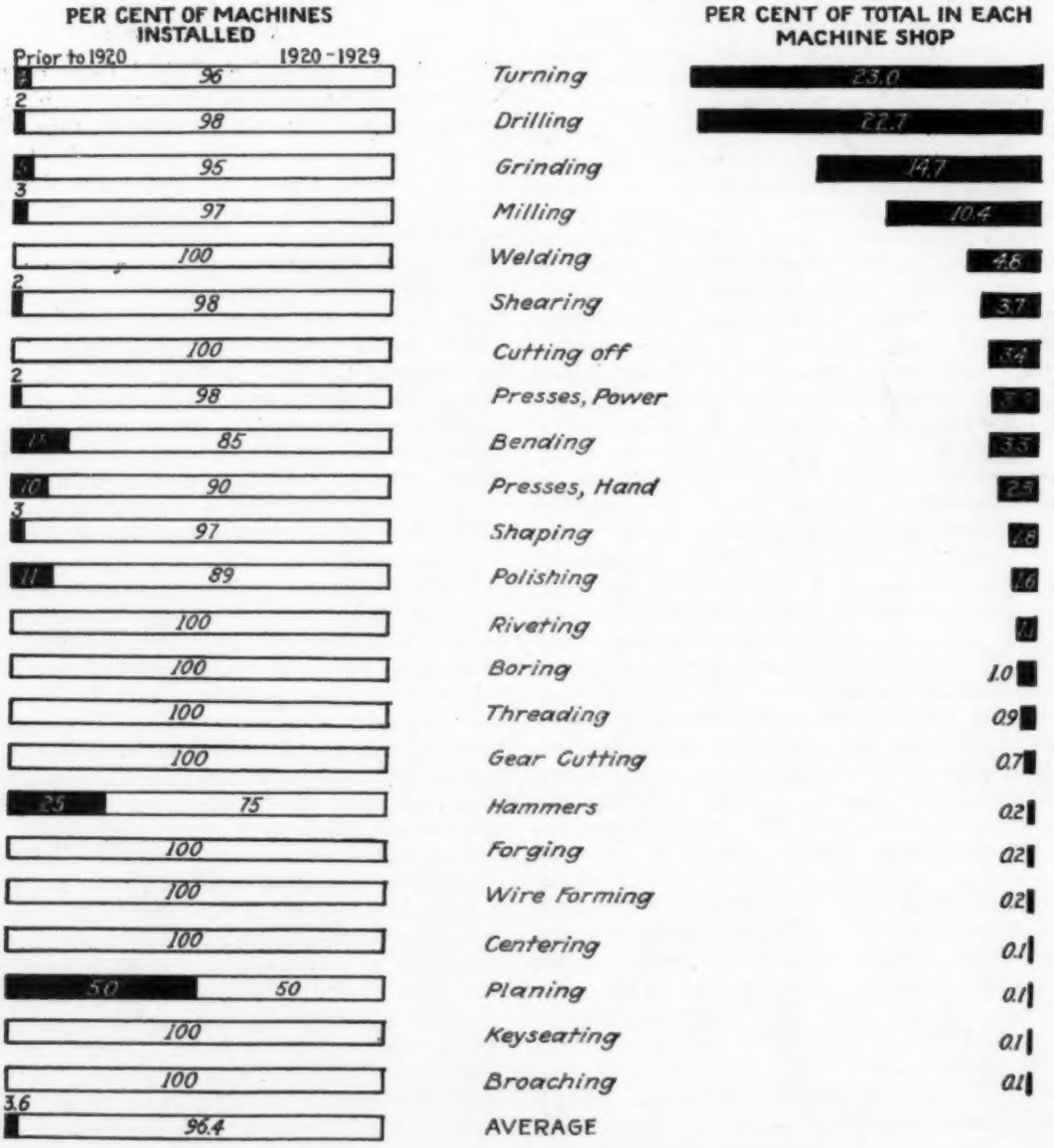
of Metal-Working Equipment

A HIGH ratio of new to old equipment would naturally be expected in a new industry like that of aircraft manufacture. This is borne out by the returns of the present survey, which indicate an average of 96.4 per cent of equipment under ten years of age. Previously reported are 45 per cent for the agricultural implement plants, 27.5 per cent for railway repair shops and car builders, and 26.7 per cent for plants making typewriters, cash registers, and calculating machines, all of which contrast strikingly with the aircraft figure.

Since the *American Machinist* 1925 inventory did not include aircraft manufacture, the change in the past five years cannot be ascertained. At the time of the previous count, the industry was so small that figures obtained from it would not have been of much value. Even with the phenomenal growth of aircraft construction in the interim, the total equipment engaged in this work is comparatively small. However, a clear picture of the physical condition of aircraft plants is important for future comparisons.

The rapidity of change in this industry made it necessary to make one departure from the usual method of determining the gross equipment figures. The number of wage earners reported in the 1927 Census of Manufactures was obviously too low to give a usable expansion factor to apply to the reporting companies. Instead, use was made of a report by the Bureau of Labor Statistics as of November, 1929, which gave more accurate results.

Report No. 4—Machines for the manufacture of aircraft, aircraft engines, and parts



Machines in Aircraft Plants

	Total Number in Plants 1930	Number Installed Before 1920
LATHES		
Engine	377	36
Hand Turret	68	3
Power Turret	120	
Automatic and Semi-Automatic	162	
Chucking (Not Chucking Machines)	62	6
Speed and Bench	71	3
Wheel, R.R.		
Axle, R.R.		
Crankshaft		
Toolroom Type	26	
Other	23	
CHUCKING MACHINES (Not Chucking Lathes)	23	
SCREW MACHINES		
Hand	179	
Automatic, Single Spindle	110	3
Automatic, Multiple Spindle	36	
CENTERING MACHINES	6	
MILLING MACHINES		
Hand (No Power Feed)	49	6
Bench		
Plain (Knee and Column Type)	256	6
Universal (Knee and Column Type)	104	3
Vertical (Knee and Column Type)	110	
Lincoln Type Manufacturing		
Continuous, Rotary Table or Drum, Type	3	3
Planer Type		
Other	42	
GEAR CUTTING MACHINES		
Rotary or Milling Type		
Hobbing	3	
Planing or Shaping	32	
Other	3	
BORING MACHINES		
Horizontal Boring, Drilling and Milling	29	
Vertical Boring Mills	16	
Other	3	
JIG BORERS	6	
DRILLING MACHINES		
Radial	71	3
Upright, One Spindle	490	13
Upright, Two or More Spindles	136	
Upright, gang (Two or More Heads)	10	
Sensitive, One Spindle	299	10
Sensitive, Two or More Spindles	153	
Sensitive, gang (Two or More Heads)	3	
Two, Three and Four Way	10	
Other	65	
THREADING MACHINES		
Single Spindle Tapping	10	
Multiple Spindle Tapping		
Pipe Threading and Cutting		
Bolt Threading and Cutting	16	
Thread Chasing		
Thread Hobbing and Milling	19	
Thread Rolling	3	
Other		
PLANERS		
Open Side	6	3
Double-Housing		
SHAPERS		
Vertical	6	
Horizontal	84	3
Slotters	6	
KEYSEATING MACHINES		
BROACHING MACHINES	3	
GRINDING MACHINES	3	
Plain Cylindrical	32	3
Universal Cylindrical	55	6
Surface, Reciprocating	10	
Surface, Rotating	29	
Internal	130	
Crankshaft		
Cutter	78	
Floor, No Feed Attachments	253	13
Bench, No Feed Attachments	123	13
Abrasive Disk	23	
Abrasive Belt	16	
Centerless	10	
Other	42	
POLISHING AND BUFFING MACHINES (Including those in Plating and other Depts.)		
Abrasive Wheel, Hand Operated	65	9
Abrasive Belt, Hand Operated		
Automatic and Semi-Automatic		
LAPPING MACHINES	10	
HONING MACHINES	13	
CUTTING-OFF MACHINES		
Parting Tool Type	10	
Power Hack Saw	55	
Rotary Cold Saw	13	
Bandsaw	62	
Other	49	
WIRE FORMING MACHINERY		
Spring Coiling		
Other	10	
WELDING AND CUTTING MACHINES		
Resistance Welding, Butt		
Resistance Welding, Spot	19	
Resistance Welding, Seam	3	
Resistance Welding, Other		
Arc Welding	13	
Electric Cutting	3	
Gas Welding	211	
Gas Cutting	10	
RIVETING MACHINES, STATIONARY		
Pneumatic	45	
Hydraulic	3	
Power	13	
PRESSES		
Punching Machines	26	
Combined Punches and Shears	6	3
Hand, Arbor	101	10
Hand, Light Punch Press Work	3	
Foot, Light Punch Press Work	32	
Power, Crank Type	62	3
Power, Toggle Type	6	
Power, Double Acting	3	
Power, Dieing Type	23	
Power, Trimming Presses	19	
Power, Forcing, Arbor, Wheel		
Hydraulic, Bending, Forming, Drawing	10	
Hydraulic, Wheel Forcing, etc.	10	
Baling, Power and Hydraulic		
Other	16	
BENDING AND STRAIGHTENING MACHINES		
Bending Brakes	65	6
Bending Rolls, Horizontal	78	19
Bending Rolls, Vertical		
Straightening Rolls	19	
Other	16	
SHEARS		
Knife	104	
Rotary, Slitting	16	
NIBBLING MACHINES	81	
HAMMERS		
Drop		
Helve		
Spring	10	3
Steam		
Pneumatic (not portable)		
Other	3	
FORGING MACHINES		
Bulldozers		
Hot Forging Machines		
Cold Headers, Bolt, Nut, etc.	13	
Cold, Swaging		
Forging & Flanging Presses, Hydraulic		
Other Forging Machines		
Total	5,441	189

IDEAS FROM PRACTICAL MEN

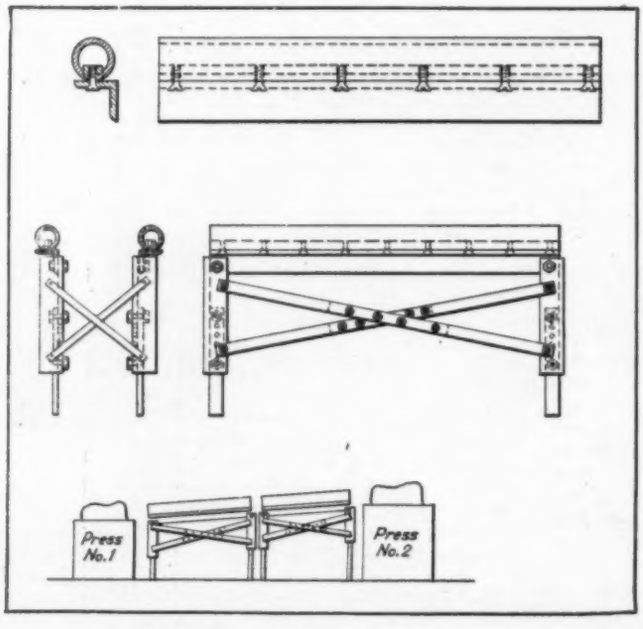
■

Protecting Stampings from Injury

JAMES K. MATTER
Supervisor, Main Press Shop,
E. G. Budd Manufacturing Company

ONE of the most irritating and costly conditions in metal stamping work is the continual scratching and marring that parts are subjected to, particularly between operations when presses are working in line-ups and the stampings are slid from one press to another. In automobile stampings, every scratch in a door, quarter panel, or any outside piece, must be buffed out or it will show through the paint. As this buffing is expensive, the slide shown in the illustration was designed to eliminate its cause. It was intended, primarily, for use between presses, but it is also very useful in certain floor-assembly operations.

Slides may be made of wood, pipe, or angle iron. Wood does not stand up. Pipe makes a very good slide,



but it offers no protection to the stampings. Angle iron, covered with rubber, makes the best slide of all. In making slides for a press shop, it is well to first give some consideration to the layout of the larger presses, which are, of course, fixed, and will not be moved. Generally, they are set up in some sort of a definite plan, with more or less definite distance between them. If the average distance between presses is 16 ft., then the slides should be 8 ft. long. It may be that the location of the presses is such that two, or even three, different lengths of slides will be necessary to properly equip the shop. The height of the slides is determined by the average height of the bolsters and the dies most commonly used.

The slide illustrated is made from 2x2x$\frac{1}{4}$-in. angle iron, and the top rails are covered with old air hose. A little study of the illustration will show how the hose is attached to the rails. A piece of $\frac{3}{4}$x$\frac{3}{16}$-in. flat steel is drilled and tapped at regular intervals, in this case, one foot, and the angle iron and the hose are drilled at the same intervals. The flat steel is inserted in the hose, so that the holes in both parts match. The hose is then laid on the rails and is fastened to them by countersunk-head screws inserted from the underside of the angle iron. The tops of the rails are now guarded by strips of hose, and there are no screws visible. The cross braces to be seen in the end view are riveted in place. The legs are fastened by bolts, and are adjustable for height, so that one end of the slide can be raised higher than the other, as shown in the lower part of the illustration.

■

Machining a Spring Clamping Bar

FRANK MAYOH
Designing Engineer, Package Machinery Company

An application of a slotted and drilled bar in which there are interesting features of machining is shown by the accompanying illustrations. The bar has a series of holes drilled in it spaced equally throughout its entire length. In addition, a series of slots is milled in each side of the bar. These slots in combination with the drilled holes give to this bar a yielding action, the purpose of which is brought out by referring to Fig. 1. In this

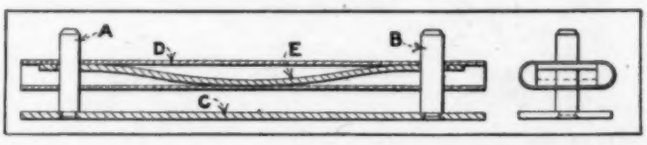
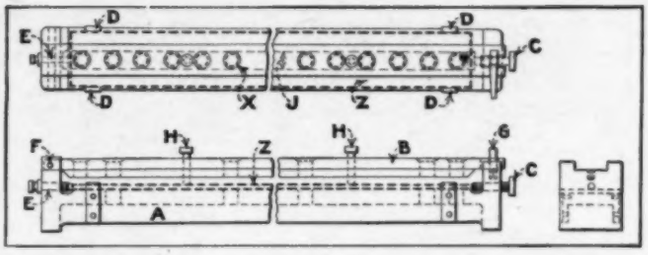


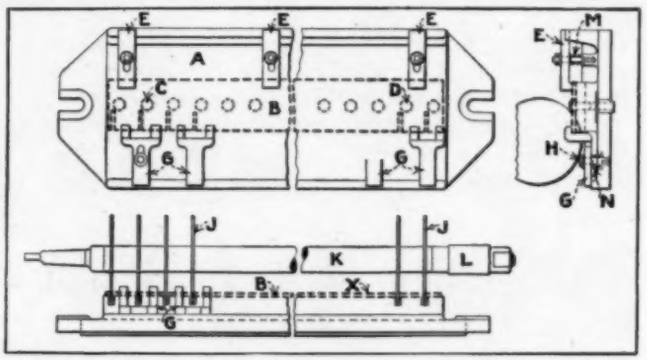
illustration two pins, *A* and *B* are attached to a plate *C*. A tube *D* having two holes in it is made to slip over the pins *A* and *B*. Inside the tube is placed a bar *E*, which has assumed a curved shape, very much exaggerated in the illustration.

For assembling purposes, the upper ends of pins *A* and *B* are beveled. The bar *E* is slipped into the tube *D* from the end, and with any pair of holes having the center distance slightly longer than the center distances between the pins, the tube containing the bar is wedged into place. Because of the endwise spring action of the bar, it will assume substantially the shape shown. Since it is trying to straighten in the tube it acts like a wedge and locks the tube securely on the pins. The tube may be pushed downward on the pins, but cannot be pulled off. This principle is used for map builders of large size and various lengths.

For machining this bar, the drill jig shown in Fig. 2 and the milling fixture shown in Fig. 3 are employed.

The jig consists of two principal parts, base *A* and a swinging drill guide bar, *B*. The base is made of cast





iron and has clearance holes for the drills. The work is located between four side guides, *D*, which are a free fit for the width of the plate. A knurled screw, *C*, forces the work endwise against a stop screw, *E*. The drill guide bar hinges on pin, *F*, and is locked down against the base of the jig by the quarter turn screw *G*. Two knurled screws, *H*, hold the work down in position. The drills are guided directly in the swing bar, because to use drill bushings, it would be necessary to weaken the drill guide bar since the centers between holes would not permit of the increased hole size necessary.

This guide bar is made of tool steel and the drill guide holes indicated at *X* are bored in the cover. The bar sides are milled away so that it is narrowed across *J* to a width just sufficient to leave metal around the drill guiding holes, to reduce the weight of the swinging member. After this, it is hardened.

After all the holes are drilled, the work is clamped as shown in Fig. 3 on a fixture used in co-operation with a gang of milling cutters on a long arbor for slotting. The fixture is of cast iron and has a finished central portion at *B* on which the work is clamped, being located both sideways and endways by two pins, *C* and *D*, which enter two of the holes previously drilled. At the rear side of the fixture, three clamps, *E*, are employed to hold the work down on the finished surface. At the front side of the fixture, a series of clamps, *G*, of the goose-neck type are used to hold the work down. One of these clamps is used between two slotted portions of the work which in effect holds down both sides, as otherwise they would be sprung by the action of the cutters in milling, causing chatter. The cutters, of which any desired number may be placed on an arbor, are indicated at *J* while the arbor is indicated at *K*. This arbor has a bushing at L for support in the overhanging arm of the milling machine. In addition, it will be noticed that the clamps are raised off the work when loosened by springs at *M* and *N*, so that within the limitations of the elongated slot they may be slid sideways for the removal of the work from the locating pins.

In performing the milling operation, the plate *B* is put in position, and the vertical feed of the milling machine used so that the gang of cutters are fed through the plate the narrow way. After the operation shown has been performed on all the parts of a production run, the work is turned over and end for end on the fixture. It is again machined with the cutters located in the proper relative positions, so they will mill the slots in the plates from the other side of the work.

After machining these plates as described, it is preferable that they be given a slight curvature by putting them in a concave bumper die before placing them in the tubes. This insures that they will then take the proper set and lay in the right direction for wedging tightly.

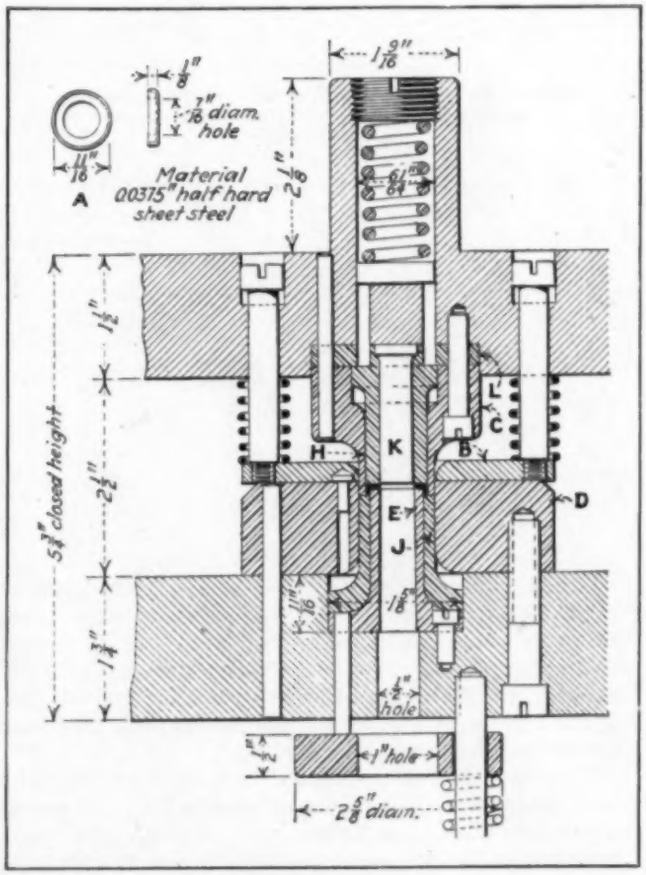
■

Combination Tools for Blanking, Forming and Piercing

C. W. HINMAN
Chief Tool Designer, Kobzy Tool Company

Having to make large quantities of pieces such as the one shown at *A*, we built the combination press tools shown in the illustration. Since each piece had a comparatively large hole in the center, it was necessary that the forming be done before the piercing, otherwise the whole would be distorted.

In operation, when the ram descends, the stripper plate *B* contacts with the strip of stock and holds it firmly by means of four coiled springs. Continued downward motion of the ram brings the blanking punch *C* into contact with the stock, blanking the part in the die *D*, and carrying the blank down in the die-block by pulling it out from under the stripper plate. Next, the blank contacts with the forming punch *E*, against which



it is held by the pressure of the shedder *H*, actuated by coiled springs in the punch holder. The blanking punch continues downward and forms the blank over the punch *E*. The length of the piercing punch *K* is such that when the shedder *H* banks against the stop plate *L*, it enters the blank and pierces the hole at just a fraction of a second before the shedder *J* banks against the end of the forming punch in the die-shoe.

On the upward stroke of the ram, the work is stripped from the forming punch by the shedder *J*, and is ejected from the blanking punch by the action of the shedder *H* in the punch. The press being inclined, the finished parts roll off into a container at the rear.

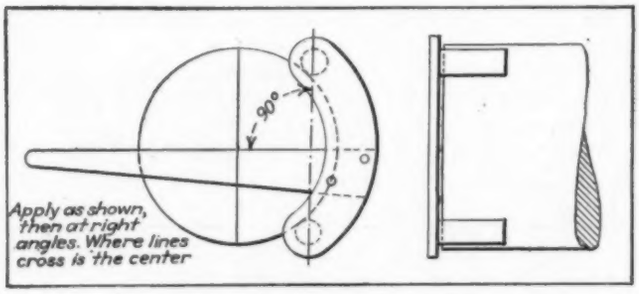
■

Constant-Center V-Blocks—*Discussion*

J. T. Towlson
London, England

Referring to the article by H. Moore, under the title given above, on page 811, Vol. 872, of the *American Machinist*, it is indeed a source of real pleasure for us old timers to witness the attempts of the present generation to surmount little difficulties in their work in machine shops.

While the ingenious device described by Mr. Moore is



The English center square is different from the one in use in this country, both in appearance and in universality

very old acquaintance of mine, it was abandoned many years ago in the shops with which I am familiar, in favor of the common and more useful center square. The essential feature in the usefulness of the center square is its portability, it being taken to the work instead of the work being taken to it, as in the device described by Mr. Moore.

In the illustration, the center square is shown applied to the end of the bar to be centered.

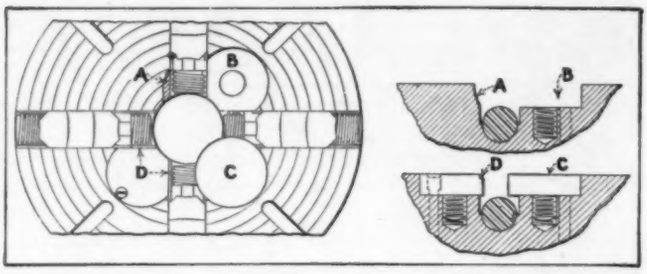
■

Repairing Lathe Chucks

John A. Cook

Two of our lathe chucks had the jaw guides broken near the center, as at *A*, and the illustration shows how the repairs were made, the work being done in a short time. Since we have gotten several more years of service out of the chucks, we think that our method of making the repairs will be of value to others who may have experienced the same difficulty.

Holes were drilled, tapped, and counterbored flush with the bottoms of the jaw guides, as shown at *B*, and screws having large heads to fit the counterbores were made. After putting in the screws, as at *C*, they were prevented



from turning by small screws put through the heads and into the bodies of the chucks. The chucks were then put in the shaper and the large screw heads were shaped on the sides, as at *D*, to match the unbroken parts of the jaw guides. If the work is carefully done, the slots will be practically as strong as when the chuck was new.

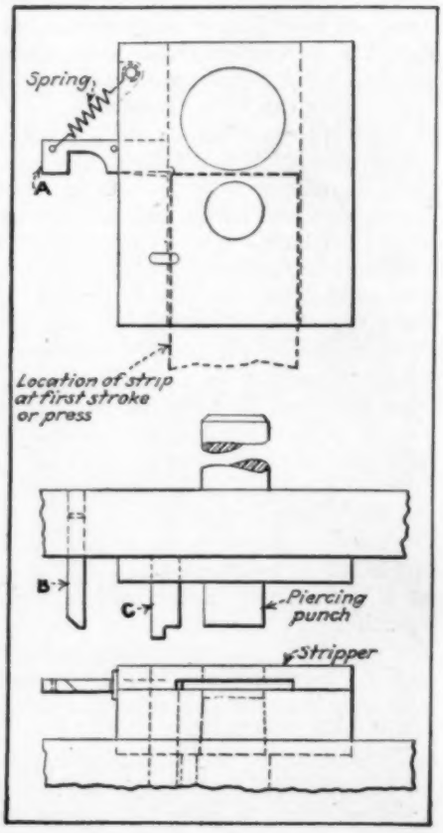
■

An Automatic Stop for Strip Stock

John L. Curcio
Tool Designer, The Massey-Harris Company

An automatic stop as applied to a progressive die having one or more progressions to complete the blank, such as a die for simultaneously blanking and piercing stator and rotor laminations, is shown in the illustration.

At the beginning, the stock is fed against the toe on the inner end of the stop *A*. As the ram descends, the stop is moved to the left, out of the way of the stock, by the beveled plunger *B* in the punch holder. As the ram ascends, the plunger is drawn out of engagement with the stop, permitting the spring to return it to its original position. However, just before the plunger releases the stop, the stock is fed forward, and when the stop is released its toe snaps into the notch cut in the side of the stock by the punch *C*. The stock is now in position for the next progressive operation. The movement of the stop is timed by raising or lowering the beveled plunger in the punch holder so that the stock is cleared when the piercing punch has made a slight indentation in it. The advantages of this stop are that it permits a complete progression of the stock from start to finish; it eliminates the use of all other plungers and stops where a series of progressions are required to com-



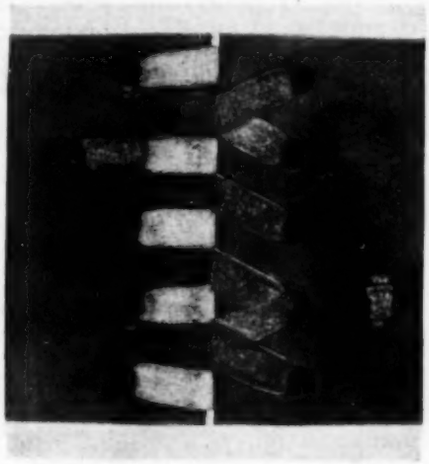
plete a blank; it lowers the cost of the dies, as both the stop and the plunger can be standardized and made in quantities; it permits the use of a more rigid stripper plate; and will always operate without a miss, which cannot be said of the so-called trigger stop.

■

Improved Method of Lacing Belts

CHARLES R. WHITEHOUSE
Standards Engineer, The Holtzer-Cabot Electric Company

Belts laced in the conventional manner are stiffer at the joints than at other parts, and the joints do not flex easily as they pass over the pulleys. This condition puts an undue strain on both the belt and the lacing, and when things begin to give way, it is often a question whether the lacing will pull out, or the belt will tear at the holes.



Both sides of a belt joint laced to form a hinge

The illustration shows the ends of a belt laced together in such a manner as to form a hinge. A belt so laced will run well on the pulley, and the method of lacing will permit the joint to accommodate itself to the curvature, even on a pulley of small diameter. The more stress there is on the belt, the tighter the lacing will draw. There is absolutely no danger of injuring the hands when shifting a belt laced in this manner.

■

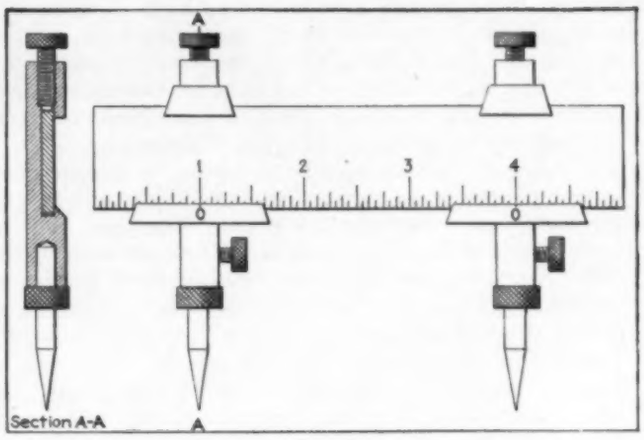
Instant-Reading Trammels

ELMER F. FELSKE
Toolmaker, Atlas Car & Manufacturing Company

Recently, I had to lay out the bolt holes in a lot of large flanges of various diameters. Since the setting of trammels to the various chords required took too much time, I decided to make a pair that could be set quickly. The result is shown in the illustration. I found this trammel to be a real timesaver on the flange job, and have since used it on a variety of other work.

The beam is a standard scale and is fitted with sliding members carrying the points, or scribers. The sliding members have beveled edges on which are scribed zero lines coinciding with the lines on the scale. Also, they are fitted with knurled-head screws; at the top to lock them in place; and at the bottom to bind the scribers. About midway of their length, the scribers have knurled collars, and the points are slightly eccentric with their bodies.

For the initial setting, the sliding members are located so that their zero lines coincide with any of the lines on the scale, preferably even inches. The points of the



scribers are then placed upon another scale, and are made to include the same dimension as that shown on the beam by the zero lines. Any discrepancy is made up for by revolving the scribers, taking advantage of their eccentricity for making the adjustment.

With the points of the scribers so set, the sliding members can be set to any required dimension on the beam with the assurance that the scriber points will be the same distance apart as that indicated by the zero lines upon the graduations of the beam. Thus, the scriber points can be quickly and accurately set to any required dimension, and the reading of the dimension is practically instantaneous.

■

Maintenance of Motor Bearings
Discussion

W. ROLAND NEEDHAM
Engineer, Design Department
English Electric Company, Limited

In an article under the title given above, on page 775, Vol. 72, of the *American Machinist*, Don R. Hammitt says very rightly, that one of the first things to investigate is the matter of adequacy, or otherwise, of the provision for lubrication. After all, with mechanical maintenance as with health, prevention is better than cure, and much less annoying.

Periodical inspection can usually be undertaken without interfering with performance. Poor design is seldom the root-cause of bearing breakdown. Lack of service-attention and absence of reasonable care in keeping the grease or oil supply adequate is oftener the culprit. In the case of bearings equipped with oil rings, if trouble develops, one obvious precaution is to inspect the functioning of the rings themselves. The rings being oil-delivery agents, it is imperative that they should discharge their duty satisfactorily. A broken ring, or one temporarily wedged, quite obviously would cause most undesirable results. Either the machine attendant, or the maintenance engineer deputed to the job should inspect oil levels and oil rings, as well as the temperature of the bearings. It should not be forgotten that often the severest lubrication test is that of a machine started up after a prolonged rest.

It is a mistake, however, to assume that a stone-cold pedestal is a sign manual of the soundest bearing health. Friction losses may be serious items in the inefficiency bill. Cold oils are much more viscous than are those reasonably warmed. The greater the oil viscosity, the

greater the friction. Accordingly, it is considerably more efficient to work at an oil temperature of not exceeding 140 deg. F. than it is to restrict the temperature to 100 deg. F., or below. On this basis, the maintenance engineer would doubtless allow a measurable oil temperature up to, perhaps, 120 deg. Fahrenheit.

A word of caution may be apropos. It is extremely unwise to attempt to cool an overheated bearing by pouring water over the adjacent shaft. The cure may be more harmful than the disease. Whatever may be the effect upon the bearing, it is certainly most hurtful to the shaft. There is little use in mending one organ, if in the process an even more vital organ is damaged. Not a few instances of such ill-advised cures are to hand. The annual technical report of the British Engine, Boiler, and Electrical Insurance Company of some three years ago, cited a like case, which resulted in shaft fracture, and the company strongly condemned the practice.

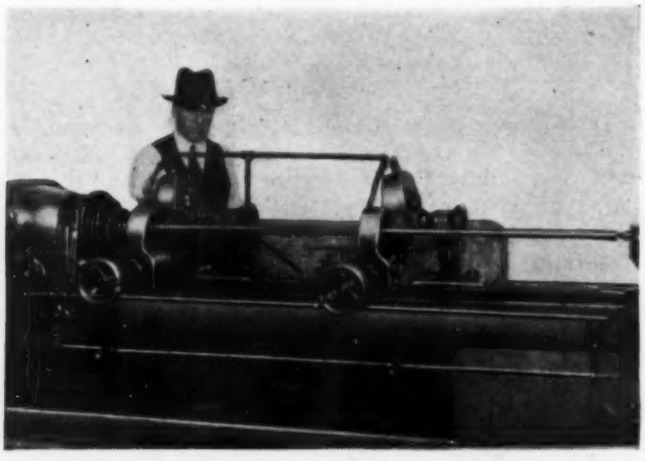
The great and wise safeguard is generally to be found in periodical oversight. A couple of minutes, while the machine is running, will usually answer the purpose quite admirably.

■

Two for One

THOMAS O. FORD

Often machining economies can be effected in so simple a manner that we wonder why we did not think of them sooner. Take for example the job of threading matrix distributor screws used in the linotype machines of the Mergenthaler Linotype Company. These screws



are fairly short, and we found that two instead of one could be swung between the centers of our Pratt and Whitney thread milling machine.

The next step was to buy an extra milling head. The screws are now made in one piece and threaded simultaneously by the two heads. When this operation is completed, they are transferred to a lathe, necked down according to the drawing, and cut apart. The result has been to halve the cost of threading these screws.

SEEN AND HEARD

●

Training Machine Operators

SERVICE has many ramifications, and most of them have been abused in one way or another. One of the latest phases came to notice the other day in a western city. The salesman of a large machinery plant was told he could have an order for a good-sized machine if he would get a good man to run it, as operators for that type of machine were scarce in that vicinity.

This incident has brought up the question of training boys to operate modern machine tools and also the advisability of dealers in machinery acting as a sort of clearing house for skilled operators. Problems of this kind do not occur in localities where mass production prevails, although operators of certain types of machines are usually in good demand. But for the more sparsely settled districts, a scarcity of operators may prevent the sale of a machine. In such instances the problem affects the manufacturer of the machine as well as for the man who sells it.

I recall one machine builder years ago whose policy was to send out good men, usually of foreman caliber, with his machines whenever possible. He was frequently criticised for letting his trained men go to other shops. But he knew that it paid to insure good results from his machines and to have a friend at court when new machines were needed. It is possible that a modification of this plan might help in the case just mentioned.

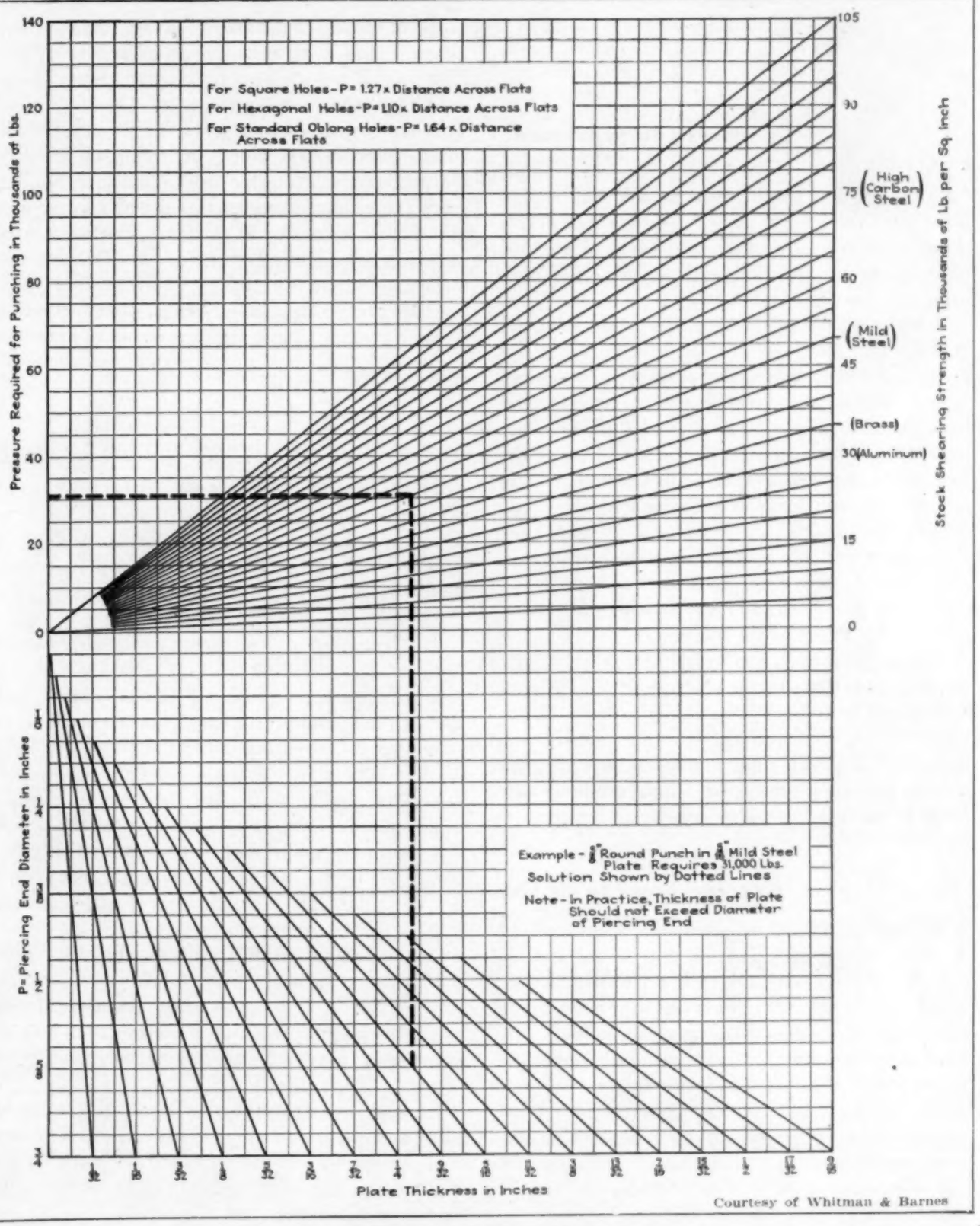
Two Shop Processes

TWO shop processes on which information seems to be lacking in many places are grinding and lapping. The grinding problem has, as a whole, been pretty well licked in the modern American shop, but in some other countries, it is not receiving the attention it deserves. Grinding spindles with too long an overhang and wheels that are much too hard seem to be the main troubles. A straight cylinder bore in a Diesel type engine is not easy to obtain. Honing has as yet been little used. On the other hand I have seen some very good jobs of surface grinding on type-casting machines and some air valves with lapped stems that were as nice fits as one ever wants to see. But there is a lack of general information as to finishing surfaces, both round and flat, in many places and especially in the Far East.

Faith Shown by Expenditures

WHEN I was a boy we used to say that faith meant "betting on a left-handed pitcher." Nowadays it means re-equipping your plant or even enlarging it in preparation of the business to come a little later. Instead of sitting tight and locking up the check book, far-sighted managers are buying new machinery and erecting new buildings. The steel industry and some of the progressive machine builders are setting an excellent example along this line. If more executives followed the same policy, they would probably find periods of depression materially shortened. —J.R.G.

Punching Pressure Chart


For Square Holes - P = 1.27 x Distance Across Flats
For Hexagonal Holes - P = 1.10 x Distance Across Flats
For Standard Oblong Holes - P = 1.64 x Distance Across Flats
Pressure Required for Punching in Thousands of Lbs.
140
120
100
80
60
40
20
0
Stock Shearing Strength in Thousands of Lb per Sq. Inch
105
90
75 (High Carbon Steel)
60
(Mild Steel)
45
(Brass)
30 (Aluminum)
15
0
P = Piercing End Diameter in Inches
Plate Thickness in Inches
Example - 3/8" Round Punch in 5/8" Mild Steel Plate Requires 31,000 Lbs.
Solution Shown by Dotted Lines
Note - In Practice, Thickness of Plate Should not Exceed Diameter of Piercing End

Courtesy of Whitman & Barnes

© American Machinist

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, September 4, 1930

VOL. 73 NO. 10

Signs of Improvement

THE drought is broken, and tillers of the soil, the greatest gamblers of us all, take a new lease of life. First came clouds, then a few showers, then a downpour, and earlier estimates of crop damage were immediately subject to revision, and greatly in need of it.

But the tillers of the soil have not been the only drought sufferers. The builders of industrial equipment have planted the seeds of new design, have fertilized them with good advertising, and have watered them with strong sales efforts. Yet orders have not sprouted on the stalks of trade. For weeks the drought of orders has been pronounced, except for a few fortunate companies.

With the breaking of the natural drought have come signs that this artificial drought of orders is also about to break. Clouds in the shape of inquiries are gathering, and a few small showers of orders have fallen in several places.

Let us pray that nature will follow its usual course, and that these showers of occasional orders will be followed shortly by a steady downpour of returning business. The signs look promising, and although signs are not orders they go a long way to produce the frame of mind that leads to the placing of orders.

Keeping Ideas In or Out

INTERCHANGE of ideas has been credited with helping materially to put the automobile industry in the front rank of low cost production. Much of this advantage has doubtless been due to the advice of machine designers and builders who have helped automobile builders solve problems as they arose in the course of manufacture. In some cases, designers of reputable concerns have been invited to study production methods and to suggest improvements. If successful, the new machines were productive of business for the builder and lowered costs of automobile production.

This practice, we are informed, has been greatly modified in some of the large plants. In fact, some of them are now said to exclude machine builders' representatives unless they are called in to help overcome some difficulty that has arisen. And even then the procedure resembles blindfolding the messenger from an enemy camp until he reaches headquarters.

Whatever the reasons given for the new policy, and the reasons vary widely, depending on whether the automobile executive or the machine builder gives them, past experience indicates that it is a mistake, when carried to extremes. In most cases exclusion of engineering visitors keeps out more information than it keeps in. Hard and fast rules are likely to prove a boomerang. It is far better to have a policy that is flexible enough to keep out the undesirables but yet to secure the benefits to be obtained from worth-while visitors.

Inspection That Costs Too Much

SO MUCH has been written on foolishly rigid inspection that there seems to be little left to be said. But a recent instance may recall to mind the huge wastes that go on because inspectors lack knowledge of practical considerations, or are not permitted to exercise judgment.

An airplane engine piston was recently rejected because after the final finishing of the piston-pin hole a minute spot was found at one point on one side of the piston. The defect was so small as to be undiscoverable except when the piston was held so that light was reflected across the spot. Although, according to the specifications, this could be called a pin hole, or unsound casting, the piston was perfectly good from every practical viewpoint. While the cost of this particular piston may not be important, it is only one of many like instances that count up to a large total.

No one advocates that work should be accepted that is defective in the practical sense. The difficulty is that the average inspector has no authority to use his judgment, and in some cases his lack of knowledge prevents his having any judgment to use.

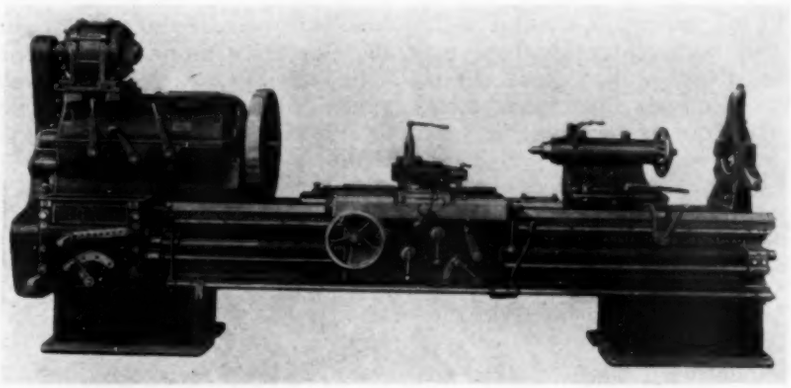
Sensible specifications, dealing largely with results, and inspectors who can and will discriminate between the fit and the unfit will do much to aid both the maker and the buyer in receiving satisfaction at a minimum cost.

SHOP EQUIPMENT NEWS

Axelson 24-In. Geared-Head Lathe

Several improvements have been introduced recently in the lathes built by the Axelson Machine Company, P.O. Box 337, Los Angeles, Calif., particularly in the heavy-duty 12-speed machine. This lathe was developed primarily for shops handling large cuts such as on oil-well drilling bits and reamers.

Three levers in front of the head-stock afford a quick selection of spindle speeds. Starting, stopping, and reversing control levers are located in close relation to one another to permit fast and safe operation. One control lever is located at the head-stock while the other travels with the carriage.



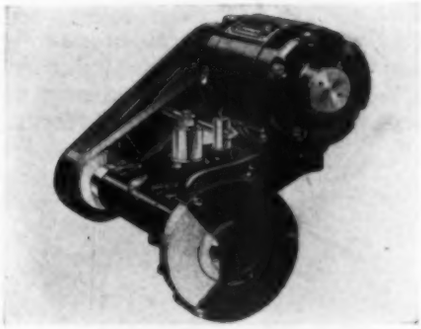
The lathe is driven by an electric motor mounted on top of the head-stock, operating directly through a silent chain. All moving head-stock parts are lubricated automatically by operation in a bath of oil. Oil level is indicated by an oil gage on the head-stock. In cases where it is desired to drive the lathe from an overhead lineshaft, a pulley for single-pulley belt drive may be furnished. An improved quick-change gear box provides 45 instantaneous changes by the simple manipulation of two levers. The index plate is located prominently so that the operator may obtain the desired setting for thread or feed at a glance. All changes may be made while the lathe is operating. Longitudinal and cross feed operation is controlled by quick-action levers located on the apron. Twelve spindle speeds are afforded, arranged in geometric progression.

Simplicity of design and accessibility of operating parts characterize the taper attachment. The attachment is available the full length of the bed, it being only necessary to tighten two lock screws and secure the taper slide to the bed of the lathe. The 8¾-in. Axelson steadyrest is standard, although the 13-, 16½-, and 20-in. sizes can be supplied upon request.

General specifications include: Swing over bed, 27½ in.; swing over carriage, 18½ in.; between centers, tailstock flush, 4 ft. 5 in.; hole through spindle, 2⅛ in.; Morse taper centers, No. 5; 12 spindle speeds; 8 to 308 r.p.m. spindle speed range; range of thread cutting, from 1 to 30, including 11½. The carriage is 32 in. long. The cross slide is 11 in. wide and the compound rest is 9 in. wide. The tool taken is 1 in. x 2 in. The bed is 23 in. wide x 16 in. deep. A 10-hp. motor is required. Height over all is 56 in., and length over all is 11 ft. 10 in.; width over all, 50 in. Net weight 10,000 lb.

Dumore No. 7 Grinder

Engineers of the Dumore Company, Racine, Wis., have developed a portable grinder in which precision is combined with the power and capacity of a production tool. A motor which develops up to ¾ hp. is used to power this unit, designated as the



No. 7 Dumore grinder. This motor operates on either a.c. or d.c.

Motor and quill may be turned end for end. This feature permits grinding on either end, and allows the operator to mount the grinder on the back of the machine if he so desires. An automatic take-up for the belt insures proper tension and eliminates slippage. It also prevents excessive pressure on the bearings. A special, separable tool post permits radial and vertical adjustmment of the tool. The tool is removable and can be mounted in a lathe, planer, shaper, milling machine, or other machine tool separate from the grinder. Other features include an efficient cooling system, an aluminum motor housing, bearings with automatic take-up, positive lubrication, belt guard, and a motor locking device.

The speed of the motor is from 12,000 to 13,000 r.p.m. Speeds of the external grinding quill vary from 4,000 to 10,000 r.p.m. With the internal grinding quill, speeds of from 10,000 to 27,000 r.p.m. are obtained. Total weight of the grinder does not exceed 45 lb.

Jones & Lamson Tangent Die, Model 21

A J&L tangent die is being produced by the Jones & Lamson Machine Company, Springfield, Vt. The die is claimed to be positive in operation and opens easily under cut because of the balanced design of the operating mechanism.

Chasers are held tangent to the work rather than radial as is the more common practice and possess the unique advantage in that the dull and worn portion on the ends may be re-

moved by grinding on the end rather than on the chamfer. Since grinding is done on the ends, machine adjustments for length of thread do not have to be made when chasers are changed. Chasers are accurate in shape, spacing, and helix angle, and are spaced in the die so relative to one another that they track perfectly.

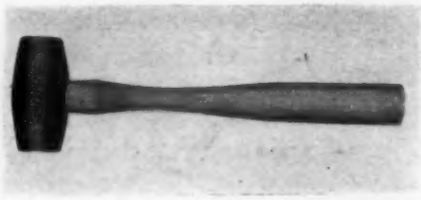
Jones & Lamson Model 21 Tangent Diehead

The dovetail on the back of the chaser is also ground and ratchet teeth are cut on the tongue of the dovetail which engage a group of mating teeth in the chaser holder. The chaser holder has a ground dovetail which receives the chaser supporting it directly behind the cutting edge.

Chasers are sharpened by removing from the end an amount equal to the pitch of the teeth on the back. They are then measured in a gage which is furnished and a graduated micrometer screw tells exactly where the cutting edge will be when the chasers are in the die. Radial movement of the chaser holder is controlled by a cam ring, the lugs being ground concentric and true with the face. In operation, backward movement of the operating sleeve causes the locking ring to rotate slightly and release the cam ring which, being forced back by the springs, opens the die. Forward movement of the operating sleeve closes the die.

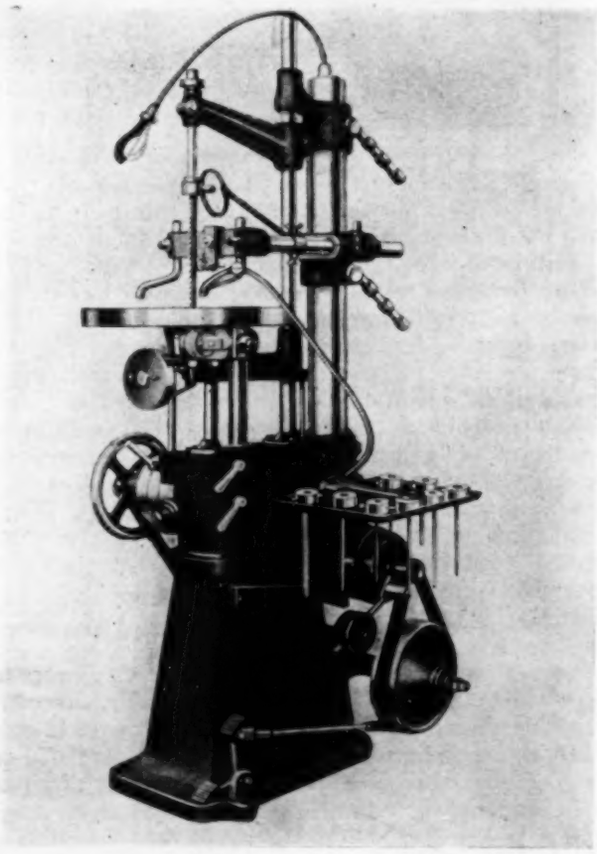
Bunting Copper-Bronze Hammer

A copper-bronze machinist's hammer has been developed in the metallurgical research laboratories of The Bunting Brass & Bronze Company, 738 Spencer St., Toledo, Ohio. This hammer utilizes an alloy that combines the necessary softness with a greater durability and a more satisfactory performance in use than the conventional copper mallet. The hammer is stocked in 1- and 2-lb. sizes. Any other size required can be produced quickly and economically. It is sold complete with fitted hickory handle, scientifically gaged to provide perfect balance.



"Rapid" Precision Filing and Sawing Machine

A filing and sawing machine made in four sizes is being marketed by J. I. Bernitz, 47-49 West St., New York City. The design and construction of these machines are the result of close co-operation with manufacturers of dies and tools. The old method of making dies by drilling or milling, is claimed to be rendered unnecessary by these machines. Punches, dies, gages, curved articles, templates, jigs, cams, forming, and drawing tools can be sawn out and filed with a clean finish. Saws and files are clamped positively in the machine. When sawing out dies of tapered form (for punch clearance), the waste can often be used as a material for other punches. The table can be tilted to 15 deg. in four directions, a scale provided showing the angle. Clamping is done by a single lever. As the table has considerable vertical adjustment also by means of a rack and pinion, any size and type of die can be accommodated. The tool bow has universal adjustment for long and short strokes. The bow is carried on five interchangeable bearings, four of which are built into the column and provided with self-acting lubrication. Rapid adjustment of the stroke is provided on machines so that the most suitable stroke can be set easily for varying thickness of material. The adjustment is effected by a hand wheel at the left side. The workholder has ample vertical adjustment on the back column. All devices are so arranged that the surface of the table and the adjacent space is available for large work. When using light saw blades, a special type roller guide is fitted on the workholder arm. On the medium- and large-sized machines, a further roller guide is also arranged below the table. A mirror



facilitates the observation of intricate work and provides ilumination when filing internal work. An electric lamp is supplied as standard equipment.

All machines, with the exception of the smallest type, can be supplied with an automatic feed. This is provided with automatic relief on the return stroke of the tool. A special lever is arranged to disengage the feed instantaneously if necessary. This arrangement makes it possible for one operator to attend to two machines.

An air pump is arranged to remove chips and filings. Machines can be supplied with the following drives: T and L pulley, single pulley and friction clutch, individual motor with idler, direct gear motor drive by pinion on the geared single pulley in connection with the usual friction clutch.

For sawing, either short length saws or coiled saws can be used. Coiled saws are arranged in a magazine below the table. For special work, saw blades can also only be held at one end. Files are either held under tension or under compression. Thin files are usually held under tension, while larger files are held under compression in holding chucks.

The speeds of these machines range from 60 to 425 strokes per minute. The smallest type is made with two speeds, namely, 300 and 425. The next two sizes for material with a thickness of $2\frac{3}{8}$ in., and $3\frac{1}{8}$ in. are arranged for three speeds, namely, 120, 175, and 255 strokes per minute, while the largest machine for material up to 5-in. thickness has four speeds, namely, 50, 100, 152, and 233. Stroke in each of the four sizes is adjustable from a minimum of $\frac{3}{8}$ in. to a maximum of $6\frac{1}{4}$ in. depending on the size of the machine. Table diameters range from $8\frac{5}{8}$ in. to $19\frac{5}{8}$ in., and the distance from the support to the center of the table varies from $4\frac{3}{4}$ in. to $12\frac{9}{16}$ in. The total height of the machine varies from 49 to 67 in., the distance from the floor to the table from 39 to 45. Floor space occupied by the smallest machine is 19x19 in., and by the largest, 39x43 in. Approximate power required varies from $\frac{1}{4}$ hp. for the smallest machine to 1 hp. for the largest. Net weight of the machine varies from 200 lb. for the smallest to 860 lb. for the largest.

Cincinnati "Hypro" 96-In. Openside Planer

One of the largest openside planers so far made in the United States has been built by the Cincinnati Planer Company, Cincinnati, Ohio. The machine has a capacity of 96 in. underneath the rail and the left-hand head can square down a casting 125 in. wide.

Operation of the planer is completely controlled by push buttons. All heads are controlled by push buttons placed on the end of the rail and on the side head. A pendant switch is supplied in a position convenient for the operator's use. This gives the operator complete control of the movement of the table as well as all of the heads and the raising and lowering of the rail. The rail is clamped to the uprights by means of an electric torque motor. By pushing a button, this torque motor will clamp and unclamp the rail and also engage the power for raising and lowering the rail. The two small motors are interlocked so that it is impossible to raise and lower the rail when it is partially clamped. To show the operator that the rail is clamped, a red light appears on both ends of the rail.

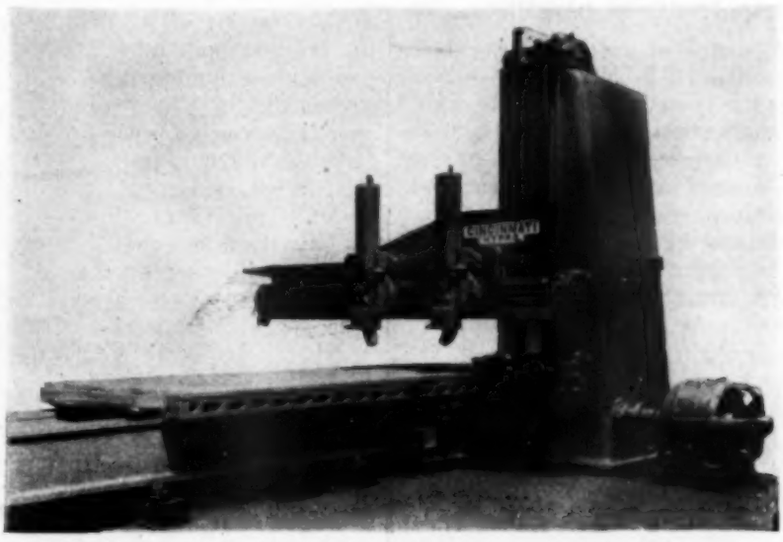
Complete lubrication is supplied to the ways, gearing, heads and other moving units by means of a pump. The heads can be operated independently of each other by rapid traverse and can be run together without causing any damage. Slides have a down feed of 40 in. below the bottom of the rail. Special tool holders are made so as to plane in pockets any distance within the capacity of the machine below the bottom of the rail. It was necessary to have extremely heavy sections in all castings to get rigidity when planing on the extreme end of the rail. It was found after a thorough test that the left-hand head could finish plane a casting parallel with the setting of the rail.

Approximate weight of the machine is 235,000 lb., the main upright weighing 60,000 lb.

Wright-Hibbard Telescopic Tier-Lift Truck

A telescopic tier-lift truck capable of lifting up to and including a height of 15 ft. has been developed by the Wright-Hibbard Industrial Electric Truck Company, Inc., Phelps, N. Y. The truck is capable of operating throughout the plant, carrying skid platforms with full loads, and, in addition, is able to lift to a height sufficient to eliminate the necessity for stacking or hand-piling. Furthermore, it is designed to be run through doorways of normal height.

By means of remote control, arranged on the side of the channels, the operator can ride on the platform and load or unload material. This remote control permits him to stop



Front view of the 96 x 96 in. openside planer, showing rail down

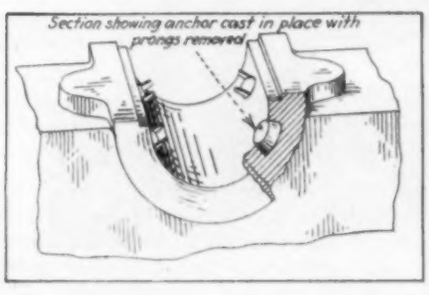
Wright - Hibbard Telescopic Tier-Lift Truck for general transporting and tiering operations

the platform at any height desired. A ladder is supplied on the side of the uprights as standard equipment so that workmen can climb to the platform if additional help is needed to assist the operator in loading or unloading when the tiering feature is employed.

The compactness of design and short turning radius allow this truck to operate under congested conditions. It can be supplied with various platform sizes and various heights in the lowered position.

Smith & Richardson Anchors for Babbitt Bearing Linings

A means of casting anchor holes for retaining babbitt linings in bearings has been developed by the Smith & Richardson Manufacturing Company, Geneva, Ill. Conical recesses are formed in the face of the casting against which the babbitt linings are to be cast by means of the "Babbitt Anchors" shown. These are made of thin, coated sheet steel. The anchors are attached to that part of the foundry mold which is to form the face of the bearing, by pressing the prongs into the sand until the open end of the cup is slightly imbedded. When the mold is poured, the metal of the casting surrounds the cup, leaving the open end exposed. The prongs, which project when the casting is taken from the sand, are removed in the cleaning operation, being scored so that they break off readily. The result is a clean undercut hole in which the bearing metal will tighten up as it shrinks, anchoring the lining securely to the casting.

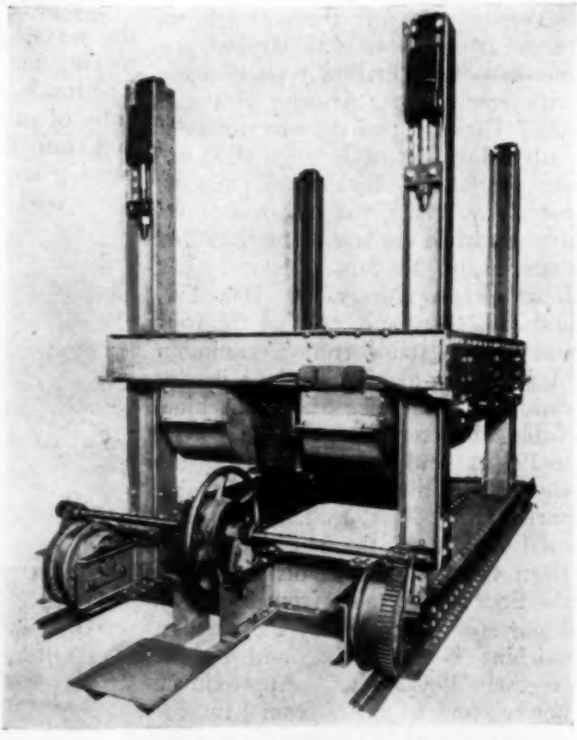


These "Babbitt Anchors" are made in two sizes, $\frac{3}{8}$x$\frac{1}{8}$ in. deep and $\frac{1}{2}$x$\frac{3}{16}$ in. deep. One anchor should be provided for each 2 sq.in. of bearing area, with a minimum of four to a half bearing.

Shaw Electric Drop Pit Table

Wire rope hoists are employed in the Shaw electric drop pit table developed by the Shaw Crane Works of Manning, Maxwell & Moore, Inc., Pershing Square Bldg., 100 E. 42nd St., New York City. The flat wire rope employed is extra flexible plow steel wire hoist cable 4x$\frac{3}{8}$ in., with a factor of safety of five at the rated hoisting capacity. The cable ends have adjustable anchorages for maintaining accurate alignment of the rail level of the table top. This equipment is built in standard capacities of 30 and 50 tons, and in both movable and stationary types.

The electrical equipment features an automatic magnetic brake on the hoist motor shaft, preventing any drift when power is shut off and facilitating accurate spotting at the top lift for the operation of the locking bars of the table top. Over travel of the hoist at both top and bottom limits is prevented by limit switches, which open automatically and apply the magnetic brake. This electrical equipment can be supplied for either a.c. or d.c., and a single-speed, pushbutton control is standard equipment. The truck is an all-steel carriage with four H-beam columns for supporting and guiding the lift. This truck travels on the pit rails on four roller-bearing, chilled iron wheels. The lifting table is fitted with an electric motor, magnetic brake, limit stops, worm and spur gearing, and four hoisting drums, double flanged for the flat wire rope. Four massive horizontally sliding locking bars are provided on the table top, and all are operated by racks and pinions from a single lever. These locking bars engage steel-lined, pit wall pockets and support the table top with the surface rails mounted thereon. When removing wheel sets, the lifting table is hoisted into position under the table top and then raised sufficiently to free



Front view of the Shaw Electric Drop Pit Table. Travel of the truck on the rails may be either by geared hand wheel or by motor drive with push-button control

the locking bars, which are then withdrawn from the wall pockets. This procedure is reversed for replacing wheel sets.

The lifting table is a self-contained assembly which hoists and lowers itself on the four flat wire rope cables guided by the four H-columns. The worm gear reductions are of the self-locking type so that the load cannot overhaul. Power is required for lowering as well as hoisting. All gears are immersed in oil and the worm gear reductions are placed in oil-tight housings. Renewable bronze bushings are employed for all shaft bearings. Alemite lubrication is standard equipment.

"H-P-M" Standard Shaft Straightening Presses

A complete line of hydraulic presses for production service in straightening shafts, axles, bars, rods and other commercial shapes has been announced by The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio. This line is designed particularly for handling long or heavy work, which can not be conveniently moved back and forth under the ram. Therefore, the pressure unit is arranged so that it may be moved along the work-supporting bed.

High production capacity is obtained from a "Fastraverse" oil-pressure system employed for operating the press. This involves means for moving the press ram to and from the work rapidly. The precision manual control provides means for governing both the direction and speed of the press ram travel. This is accomplished through a single, conveniently located, hand lever. When the lever is in mid position, the press is at rest. When it is moved forward from neutral, the ram is moved forward and when it is reversed, the ram returns. The speed of the ram motion is proportional to the distance the operating lever is moved from neutral. Motion of the press ram during both the rapid advance and the slower pressing speed is controlled by the same lever. Thus the accuracy with which the operator can bring a shaft into line is facilitated by the use of this lever, which can be employed for cutting off the pressure at the critical point.

Six standard sizes of shaft straightening presses are available, the first four of which have capacities of 75, 100, 150, and 200 tons pressure, respectively. This model is shown in Fig. 1. The last two heavy-duty sizes have pressure capacities of 300 and 400 tons, a representative model being illustrated in Fig. 2.

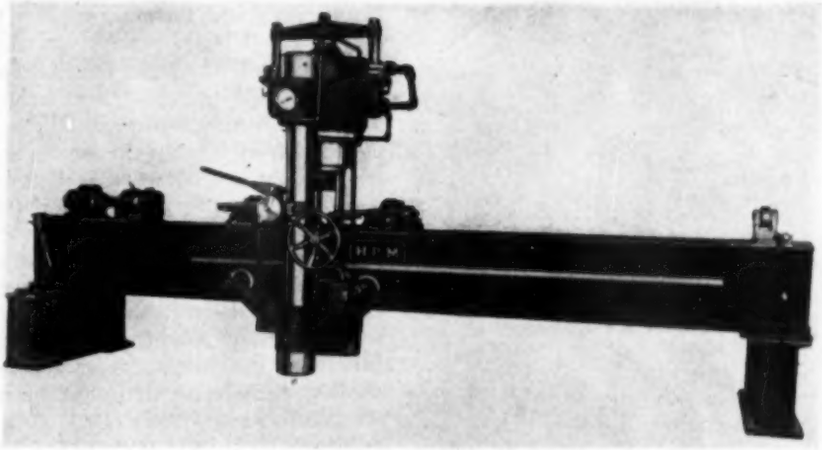
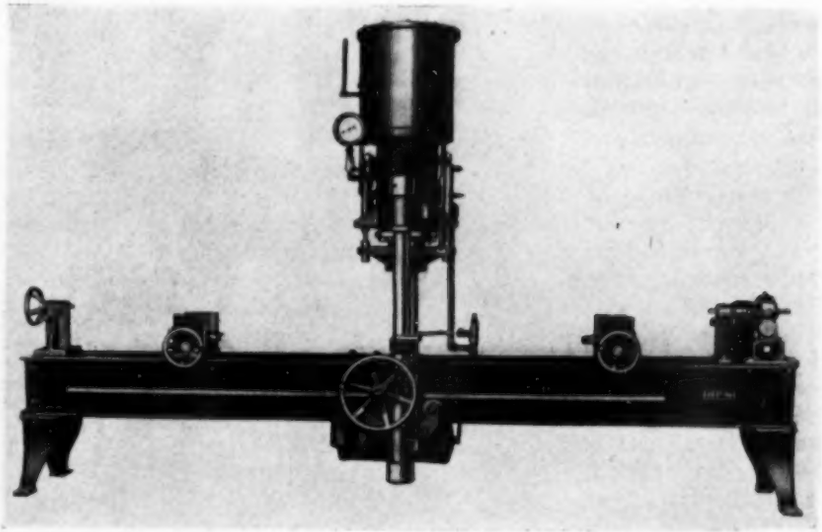


Fig. 2—Representative model of the heavy duty "H-P-M" Shaft Straightening Press, available in pressure capacities of 300 and 400 tons



"H-P-M" Standard Shaft Straightening Press, which is available in four sizes having pressure capacities of 75, 100, 150 and 200 tons. Close control of pressure and ram speed is afforded by a directional lever

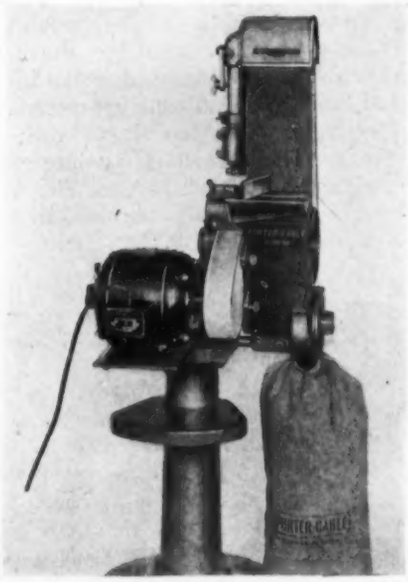
Porter-Cable Type B-9 Belt Sander and Grinder

For quickly putting a straight grain finish on metal, wood, fiber, Bakelite, or other material, a belt sander has been developed by the Porter-Cable Machine Company, Syracuse, N. Y. The finish produced is even and true because the flat metal bed under the belt serves as a firm backing. Other operations which can be performed are removing burrs, cleaning up castings, grinding bearing caps, replacing light milling operations, sharpening tools, polishing, and sanding.

The type B-9 sander has a two-speed arrangement so that the proper surfacing speed for wood or metal may be obtained quickly. The speed

is quickly changed by lifting the motor and placing the belt into the proper grooves in the motor and drum pulleys, with the motor weight acting as an automatic take-up on the "V" belt.

A vacuum dust collecting system is built into the machine. The lower dust chute has a vacuum fan, driven by a small V-belt from the drum pulley. Most of the dust is carried through the chute into a bag or conveyed elsewhere by attaching a flexible pipe. High vacuum also prevents excessive clogging of the belt and keeps the grit on the belt sharper.



Porter-Cable Type B-9 Belt Sander and Grinder

Changing abrasive belts on this machine is done quickly without removing the guard or idler pulley. The belt tension is controlled by a spring in steel post which acts on idler pulley and takes up the belt stretch automatically. Tracking of the belt is controlled by one thumb screw which tightens the idler pulley.

The type B-9 can be used in either a vertical or horizontal position as the work requires. This change can be made by loosening two wing screws. For the horizontal position a special edging guide is provided, which clamps in place of the table, thus allowing the work to be handled and square edges to be assured. The sanding or grinding bed can be adjusted in and out to give the correct surface tension to the belt and to allow the use of a felt cover for flexibility, or the bed may be removed entirely for slack belt sanding. Furthermore, it can be reversed if worn. Compound angles can be secured by a tilting

Specifications: Belt speeds, 3,000 and 4,000 ft. per minute; motor speed, 1,725 r.p.m.; abrasive belt, 6 in. wide x 54½ in. long; belt backing plate, 6¼ in. x 12 in.; adjustable table, 6 in. x 7¼ in.; table height from floor, 40 in.; net weight, 260 lb.; hp. required, 1.

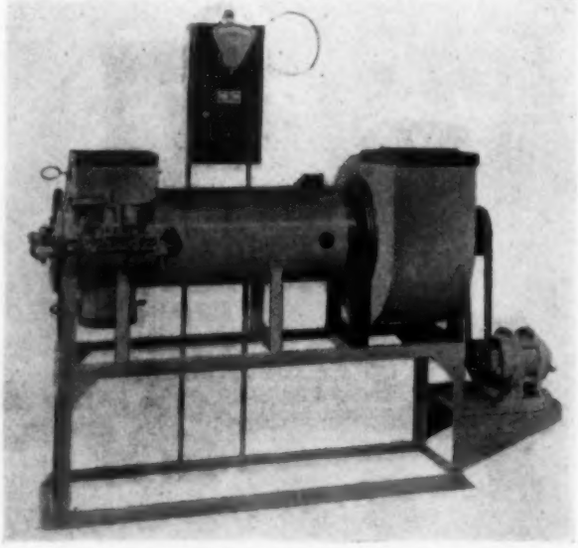
Maehler Recirculation and Incineration Equipment for Enameling Ovens

To effect greater heat economy and to minimize explosion hazards in japanning and enameling, The Paul Maehler Company, 2208 West Lake St., Chicago, Ill., has developed equipment to be located outside of such ovens for the purpose of supplying heat and incinerating the vapors distilled from enamel. Recirculation of air through the oven by means of this equipment causes more uniform temperature throughout the oven interior to be obtained and the quality of work is bettered. The air and vapors are drawn from the top of the oven by a high temperature suction fan located at the exhaust end of the heater, passed through the heater, and returned to the bottom of the oven. Since the fan is of the suction type, an independent throat and air intake for gas combustion may be provided. A soft, quiet visible burner flame is produced and the use of a visible pilot and automatic electric ignition is possible. An adjustable fresh air inlet at the intake end of the heater permits the introduction of fresh air into the heater at room temperature, when desired.

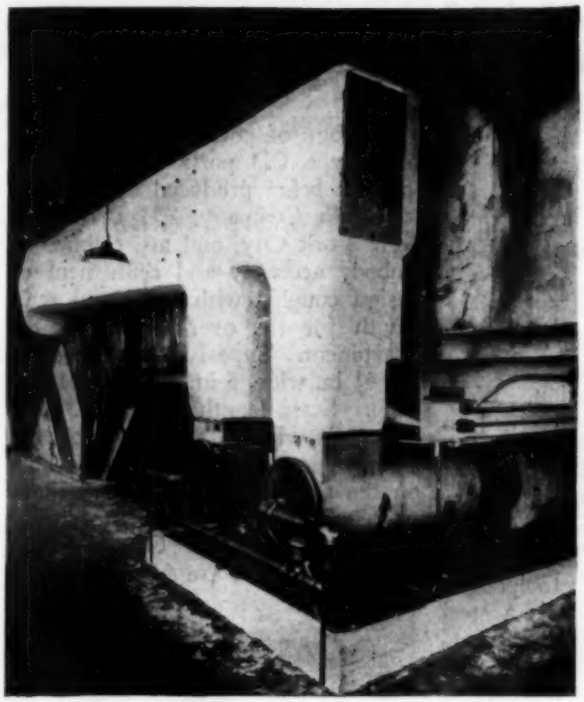
In the operation of the heater, the air from the oven with its vapor content passes through the heater flame where all explosive gases developed in the oven are incinerated. In their combustion a notable economy is effected, in that the burning of vapors generated from enamel give approximately 150,000 B.t.u. per gallon. As the entire volume of circulating air passes through the heater many times a minute, it is not possible for a sufficient quantity of volatile vapors to be present to create any possibility of explosion.

Under repeated tests the heater has shown a continuous efficiency of 95 to 99 per cent and operates at a temperature one-third above the oven temperature. For example, at 450 deg. F. oven temperature the circulating air is returned to the heater at 400 deg. F., and it is thus necessary to raise its temperature but 50 per cent to maintain the oven temperature. An accurate thermostatic control can be set for any desired temperature and controls the fuel flow to maintain this setting.

Notwithstanding the constant recirculation of the air, tests have shown the loss in the oxygen content of the circulating medium never exceeds more than 2 per cent, and thus



Side view of Maehler equipment for industrial japanning and enameling ovens, which heats the air, recirculates it, and incinerates vapors distilled from the enamel



Installation view of the Maehler Heater, showing the duct work alongside an industrial oven

the oxidizing effect of the air is not materially reduced. Variation in temperature at any two points in the oven is furthermore claimed to be not more than 6 deg. under usual conditions and never more than 10 deg. The floor, usually the coldest part of the oven, becomes the warmest. Using slotted ducts for the delivery of the heated air to the oven, and for the exhaust, the full dimensions of the oven are maintained for the work in process and the walls are smooth and readily cleaned and kept free from dust.

Guibert "Toggle Bug" Portable Drill

A portable drill claimed to equal radial or gantry radial drills in scope of action and economy has been placed on the market by the Guibert Steel Company, Pittsburgh, Pa. Its trade name is "Toggle Bug," derived from the fact that pressure on the drill point is applied and controlled by means of a powerful toggle and the machine is mounted on a buggy or carriage. Power is furnished by a 2-hp. ball bearing motor geared to a sliding spindle or toolholder, in which the drill bit is held by a standard tapered socket. Coolant is applied at the drill point from a tank mounted on the machine, the flow being hand controlled.

A simple system of weights and counterweights gives the machine the necessary weight for drilling large holes and maintaining balance. Thus, it can be moved along with one hand, although the total weight is approximately 1,200 lb. A rigid steel frame supports the motor, which is mounted on two steel rollers equipped with roller bearings. The operator leans or sits on the end of a 5-ft. handle attached to the toggle. This in turn connects the handle, frame and spindle in such a manner that pressure can be brought upon the drill. A screw in the shape of a cross is attached to the toggle, so that by means of handwheels the stroke of the drill can be controlled from $\frac{1}{64}$ to 6 in.

A clutch on the spindle allows the toolholder to be raised or lowered as required. The handle is adjustable so that it can be arranged to suit the height of the workman. In addition to the rollers, the frame rests on adjustable legs, which permits drilling a vertical hole in materials of different thicknesses and also permits getting close to flanges in the webs of large beams and H-sections. An extension is supplied with each machine for lengthening the rollers so that they ride the edges of the flanges when it is necessary to drill in the webs of H-sections. A special attachment is also furnished for use in reaming the chords of bridges.

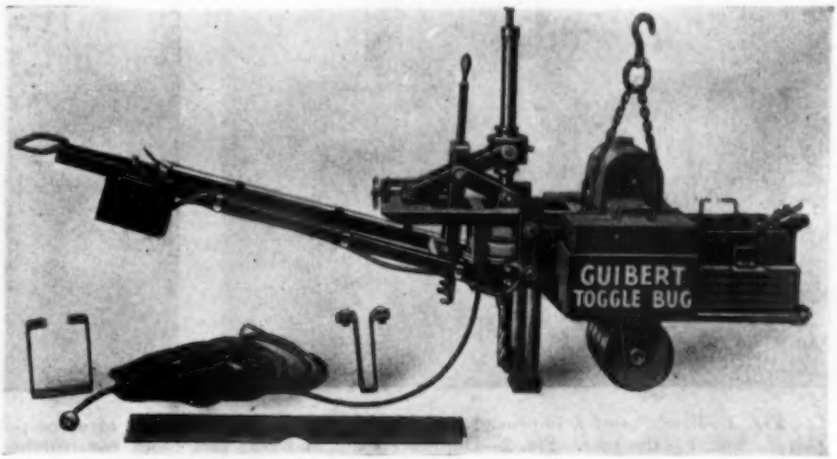
The machine is equipped with a hook and chain for transporting it by means of a crane, or can be stripped of the weights and counterweights and carried by three men, or it can be rolled along on the rollers. All gears and bearings are encased in oil-proof housings.

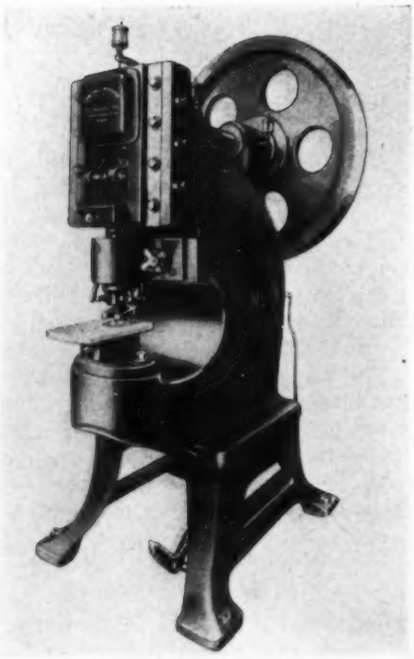
The "Toggle Bug" moves so easily and readily that it is claimed drilling in large sections can be effected faster by a single operator than a crew of two or three can perform the same work by other methods.

Campbell No. 3 Nibbling Machine

Sheet metal from $\frac{1}{8}$ to $\frac{1}{4}$ in. in thickness can be handled on the No. 3 nibbling machine developed by A. C. Campbell, Inc., Bridgeport, Conn. The machine is recommended for cutting out original pieces and also for production work where it is not feasible to make expensive punches and dies. The machine cuts fast in any direction, approximately 20 linear inches per minute, and like the smaller machine it works on the circular punch and die principle with a pilot to prevent the work from slipping and the punch from taking too large bites. Clean cutting is produced without burrs, and very little finishing is required when an absolutely smooth edge is demanded.

Circles can be accurately and easily cut with the circle cutting attachment furnished. For making original cuts,





Stock up to ¾ in. can be cut to shape by the Campbell No. 3 Nibbling Machine

the use of a straight edge and a French curve is recommended, as this insures close cutting to the line by even an inexperienced operator. The original piece may then be used as a templet for cutting duplicate pieces. The machine has three strokes, 1 in., 1 3/16 in., and ½ in., making it easy to handle all thickness of sheets from ⅜ to ¾ in. The ⅞-in. punch can be set quickly in the die by turning the stroke adjustment collar. The stripper plate is set in the correct position by releasing the locking lever and turning the handwheel.

Specifications: Floor space required without motor, 5 ft. x 4 ft. 2 in.; height over wheel, 8 ft. 6 in.; depth of throat, 15 in.; hp. required, 7½; net weight, belt drive, 9,000 lb.

Reed-Prentice Improved Front and Rear Tool Block Construction for Lathes

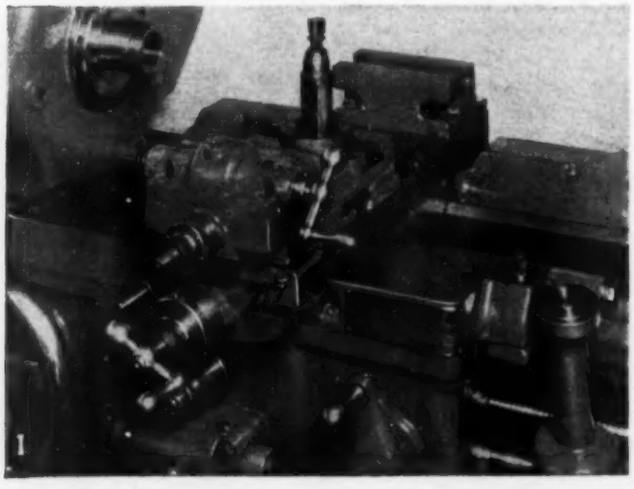
Improved front and rear tool block construction furnished recently by Reed-Prentice Corporation, Worcester, Mass., has been designed to do away with interference between the handles of the compound rest and the cross feed screw. In Fig. 1 is shown an improved type consisting of a compound rest in the front and a plain T-slot block with toolpost at the rear. The rear block is a steel casting and has independent adjustment while the lower slide is cast integral. The compound block is of steel with screw adjustment permitting greater clearance and the use of a larger crank handle. Operation of the screw is from the usual position or from the shaft mounted at right angles and connected to the screw through bevel gears.

In Fig. 2 is shown duplicate front and rear block construction, except that the rear block is provided with separate screw for in and out adjustment. This construction allows independent operation of the rear tools without disturbing the front tool set-up. The quick hand feed is furnished for the screw and the micrometer dial is employed for positioning the rear block accurately.

Roller-Smith Type PD Volt-Ammeter

A group of pocket-size direct current Type PD portable volt-ammeters are being produced by the Roller-Smith Company, 233 Broadway, New York City, and are claimed to embody accuracy and refinement of design coupled with maximum scale length for the over-all size of the instrument. Type PD volt-ammeters are 4½ in. wide, 5 in. long, and 1⅝ in. deep. Scale length is 3 5/16 in. Accuracy is within 1 per cent of full scale value. The movement is built on the upper side of a heavy metal plate which carries also the binding posts and switches. On the lower side of the plate are fastened resist-

ance spools and shunts so that the plate acts as a supporting medium for every internal member. The cover is drawn metal and the base is molded Bakelite. The movement employed is a d'Arsonval instrument. This instrument is available in five different sizes each in four types.



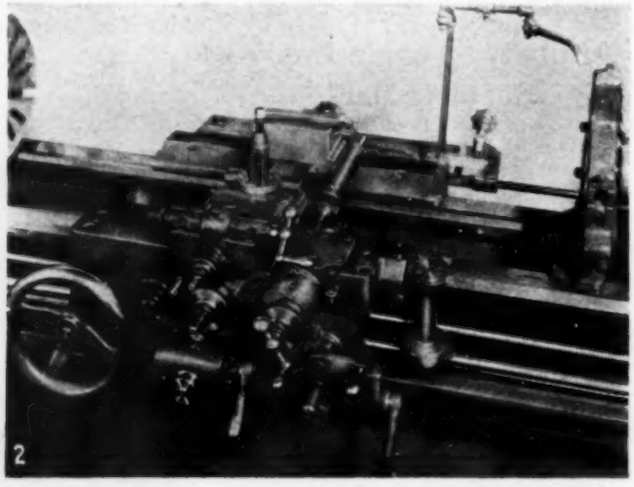


Fig. 1—Reed-Prentice improved tool block construction, consisting of a compound rest in front, a plain T-slot block in the rear. Fig. 2—Duplicate front and rear tool block construction with separate adjustments

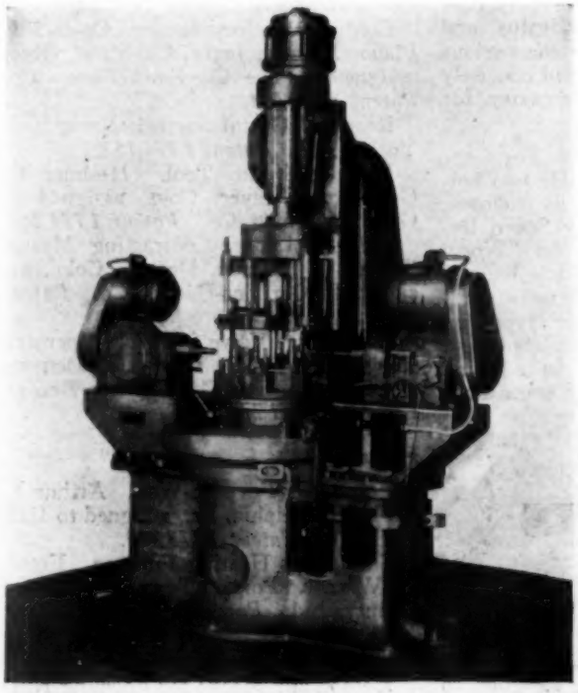
EQUIPMENT ADAPTATIONS

RECENTLY DEVELOPED BY THE MAKERS

Bradford Production Drilling Machine with 4-Position Hand Turret

Special tooling equipment for producing the pump body of an electric refrigerator is employed on the three-head Bradford machine illustrated. This tooling equipment, furnished by the Bradford Machine Tool Company, 659 Evans St., Cincinnati, Ohio, consists of four workholding fixtures mounted on a hand-operated turret. One station is used for loading and unloading the fixture and a progressive series of drilling and reaming operations are carried out at the other three stations. The horizontal unit drills single holes, while the cluster box mounted on the vertical head carries the tools in three groups in order that this unit may perform operations in each of the three working stations.

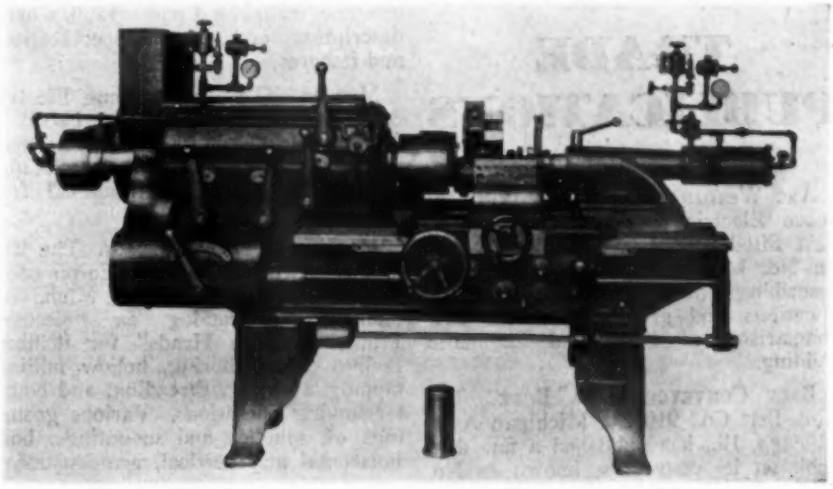
The vertical unit drills and reams two holes 0.372 in. in diameter, drills six holes 0.332 in. in diameter, and drills two holes 0.281 in. in diameter, and counterbores the two 0.281-in. holes to $\frac{13}{32}$ in. diameter by 0.28 in. deep. All holes are drilled in SAE 1020 steel, $1\frac{1}{4}$ in. thick. The horizontal units drill two $\frac{1}{4}$-in. holes through $\frac{3}{4}$-in. stock. A floor-to-floor time of 19 seconds per piece is obtained.



A hand-operated, four-position turret, together with two horizontal and one vertical unit, permits a floor-to-floor time of 19 seconds per piece on this Bradford machine

This machine is adaptable for general production work by changing the tooling equipment. Multiple-spindle cluster boxes may be mounted on the horizontal units and the turret may be arranged for automatic indexing. Each unit is equipped with an individual motor drive and an additional motor is provided to operate the pump for the coolant supply system. An independent switch, having overload and underload protection is provided for each motor. Starting and stopping of the entire machine are controlled through a single push button.

The feeding mechanism is controlled by means of a hand-operated poppet valve mounted near the front of the table. This valve operates air-operated trip dogs attached to the feeding levers of each unit. All spindles advance simultaneously in rapid traverse, slow down automatically to their proper feeding rates, and then return in rapid traverse to the starting point. During the drilling cycle, the operator is occupied in unloading, cleaning, and reloading the fixture for the next cycle, thereby eliminating lost time, which is limited to one second required for the indexing motion.



Monarch Special 20 In. by 6 Ft. Lathe equipped with an air chuck, air-operated ball-bearing tail stock, and back arm facing attachment for machining cylinder sleeves in 15 seconds each. Previous method, 2½ minutes

Monarch Special 20 In. by 6 Ft. Lathe

The Monarch Machine Tool Company, Sidney, Ohio, has developed a special 20 in. x 6 ft. Model "H" lathe. The eight-speed Model "L" helical-geared Timkenized headstock is arranged for a single pulley drive, or direct motor drive. The lathe is equipped with a special 3-jaw Logansport air chuck and an air cylinder for operating the tailstock spindle. In addition, this unit has an anti-friction bearing cone tailstock center and back arm facing attachment for facing the cylinder, which is shown beneath the lathe. There are three

tungsten-carbide turning tools in the front tool rest and one in the rear facing rest.

The dimensions of the cylinder sleeve are 4⅜" O. D. x 9½ in. long. Cylinder sleeves are machined at the rate of 300 surface feet per minute, 240 r.p.m. of the spindle, and 0.040 in. feed. The time required to turn each piece was reduced to 15 seconds whereas by the former method it was 2½ minutes.

TRADE PUBLICATIONS

ARC WELDING DATA. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued Bulletin No. 14 on automatic arc welding, describing a number of arc welding applications and giving an actual cost comparison of hand and automatic welding.

BELT CONVEYOR DATA BOOK. The Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., has published a fine data book on its conveyors, known as No. 1615. Idlers are shown for various types of service, together with lubrication systems and rolls. Operating and engineering suggestions follow, together with many tables on the selection of equipment. Balance of the catalog is made up of descriptions of speed reductions employed, specifications for this equipment, and miscellaneous accessories. The booklet is indexed and bound in a leatherette cover. It contains 176, 9 x 6-in. pages.

CONVEYOR FURNACES. An eight-page bulletin with 16 illustrations, describing new gas and electric chain belt conveyor furnaces, heat-treating miscellaneous small and medium size parts and products without pans or trays of any kind, may be obtained from The Electric Furnace Company, Salem, Ohio.

GAGES. The B. C. Ames Co., Waltham, Mass., has issued Catalog No. 50 illustrating the gage construction employed, the various styles available, mountings in uprights and comparators, dial micrometers and cylinder gages.

GAS-FIRED UNIT HEATERS. The Buffalo Forge Co., Buffalo, N. Y., has issued Bulletin No. 2754 on gas unit heaters with fan circulation and temperature regulation devices.

FURNACE, TUBE. The Sentry Co., Taunton, Mass., has available a circular on its new Model "U" tube furnace for combustion analysis and similar work requiring a small electric tube furnace to operate at high temperatures.

FURNACES. An eight-page bulletin illustrating oil- and gas-fired continuous and batch-type billet heating, forging and car type furnaces for heating, normalizing and heat treating, also labor saving material handling equipment, may be obtained from The Electric Furnace Company, Salem, Ohio.

MATERIALS HANDLING MACHINERY. The Barber-Greene Company, Aurora, Ill., has published a book entitled "The Barber-Greene Line" which is a 32-page catalog showing the complete line of Barber-Greene materials handling machinery. A page is devoted to each machine, including a photograph, a brief description, and general specifications and features.

MOTORS. The Westinghouse Electric & Manufacturing Co. has issued a four-page leaflet on its type CW wound-rotor induction motors known as leaflet 20490, and giving constructional features.

MULTIPLE-SPINDLE HEADS. The Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., has published a catalog on "Kreuger Multiple-Spindle Heads" for drilling, facing, counter-boring, hollow milling, tapping, reaming, threading, and counter-sinking operations. Various groupings of spindles and mountings, both horizontal and vertical, are illustrated.

PLATING SOLUTION ANALYSIS. The Hanson-Van Winkle-Munning Co., Matawan, N. J., has prepared from its experience a booklet entitled "Simple Methods of Analyzing Plating Solutions." This small booklet, distributed gratis, covers the principles involved in analysis, the use of apparatus, and the methods of analysis for the various plating solutions, all presented concisely with a list of solutions necessary for such work.

SPEED REDUCERS. Gears & Forgings, Cleveland, Ohio, has available two bulletins on speed reducers as follows: Bulletin B-1 on "Planetary Speed Reducers" and Bulletin C-1 on "Worm Gear Speed Reducers." Each bulletin gives complete information on the advantages of the particular type, its construction, the sizes available, and many installation views. In addition Bulletin C-1 gives a list of worm hobs available.

PATENTS

August 26, 1930

Metal-Working Machinery

Four-High Rolling Mill. Otto B. Lindquist, Tarentum, Pa., assigned to Allegheny Steel Co. *Patent 1,773,737.*

Drop Pit. Walter Nagell, Harvey, Ill., assigned to Whiting Corporation. *Patent 1,773,746.*

Press. Raymond T. Anderson, Cleveland, Ohio, assigned to The V. D. Anderson, Co. *Patent 1,773,771.*

Machine Saw. William Westwood, London, England, assigned to Fred Cecil Jarvis, Lord Leslie Jarvis, and Alfred Wallace Jarvis, London, England. *Patent 1,773,800.*

Metal-Bending Machine. Walter L. Fry, Scarsdale, N. Y., assigned to Wil-Fry Corporation. *Patent 1,773,812.*

Machine For Forming Metal Bands. John F. Peters, Rochester, N. Y., assigned to American Can Co. *Patent 1,773,856.*

Friction Spindle Press and Method for the Maximum Utilization Thereof. Otto May, Newark, N. J. *Patent 1,774,148.*

Sheet-Metal-Working Machine. Leiv S. Platou, Southington, Conn., assigned to The Peck, Stow & Wilcox Co. *Patent 1,774,155.*

Electric Tracer-Control Machine For Die Sinking and the Like. Emil R. Lochman, Milwaukee, Wis. *Patent 1,774,279.*

Rolling Mill. Clarence J. Klein, Bellevue, Pa., assigned to United Engineering & Foundry Co. *Patent 1,774,383.*

Tools and Attachments

Safety Device for Punch Presses or the Like. Ronald E. J. Nordquist, Maplewood, N. J., and Magnus E. Widell, Cincinnati, Ohio, assigned to American Can Co. *Patent 1,773,849.*

Sprocket - Center - Removing Means. Robert S. Brown, New Britain, Conn., assigned to The New Britain Machine Co. *Patent 1,774,050.*

Control Mechanism for Open-Side Planers. Jacob Jenne, Cleveland, Ohio, assigned to The Cleveland Planer Co. *Patent 1,774,061.*

Reamer. Gustaf Samuel Olson, New York, N. Y. *Patent 1,774,152.*

Variable-Stroke Tool. Hjalmer C. Gustafson, Denver, Colo., assigned to Gardner-Denver Co. *Patent 1,774,266.*

Drill-Steel Bore-Contracting Means. Gustav C. Pearson, Denver, Colo., assigned to Gardner-Denver Co. *Patent 1,774,290.*

Automotive Valve for Fluid-Operated Tools. Edward F. Terry, Jr., Denver, Colo., assigned to The Gardner-Denver Co. *Patent 1,774,302.*

Furnaces

Refractory Furnace Wall. Arthur F. Hall, Philadelphia, Pa., assigned to Hall Arch Co. *Patent 1,773,729.*

Continuous Heating Furnace. Frank J. Werner, Porter Township, Porter County, Ind. *Patent 1,774,306.*

Processes

Method and Means for Forming Nut-Blank Bars. George F. Woelfel, Lakewood, Ohio, assigned to The Commercial Clearing Corporation. *Patent 1,773,836.*

NEWS OF THE WEEK

Metal-Working Machinery Exports Drop Off Slightly in July

WASHINGTON, D. C., Sept. 3—Foreign trade in power-driven metal-working machinery suffered less in proportion in July than did any other sub-division of machinery exports. July exports of metal-working machinery were valued at $2,895,309. This is only slightly less than the value of exports of July, 1929, and falls only $465,000 under the total for June of this year. Exports of the entire group consisting of machinery and vehicles in July were valued at $57,708,282, as compared with $107,707,762 in July, 1929. Exports in June were valued at $66,-856,917.

Of the total for July, $8,679,078 was represented by the exports of electrical machinery and apparatus. This represents a decline from $11,275,998 in July, 1929, and from $9,714,659 in June.

Industrial machinery to the value of $17,986,482 was exported in July. This compares with $24,322,394 in July, 1929, and with $21,095,093 in June. The totals of the sub-divisions under industrial machinery are as follows:

	July, 1929	July, 1930
Power generating machinery except electrical and automotive	$2,880,301	$1,507,130
Construction and conveying machinery	2,447,075	2,295,839
Mining, well and pumping machinery	5,153,617	3,280,795
Power driven metal-working machinery	2,917,137	2,895,309
Other metal-working machinery	633,094	490,576
Textile machinery	1,192,028	641,170
Sewing machines	994,665	401,791
Shoe machinery	123,744	115,532
Other industrial machinery	7,779,354	6,289,571

Many items coming under the head of power-driven metal-working machinery show increases as compared with July of last year. There was a marked upturn in the export of engine lathes. Fewer turret lathes were sent abroad, but the value of 35 lathes exported in July was greater than the value of 43 lathes exported in July of last year. Some milling machines were exported. The same is true of drilling and grinding machines. Forging machinery exports increased, as did those of rolling mill machinery and of foundry and molding equipment. Decreases were confined chiefly to thread-cutting and automatic screw machines, gear-cutting machines, planers and shapers, surface and internal grinding machines and to sheet and plate machines. There was a decline in the export of pneumatic tools, in chucks, and in drills and reamers.

Firm action was taken recently by the Navy Department against yielding authority to the Comptroller General in the purchase of machine tools and other equipment. Matters of technical merit must be decided by experts who are buying the machinery and who are familiar with the use intended, it is maintained. An apparent clash of jurisdiction arose over bids for two motor-driven shapers for the Philadelphia aircraft factory, a test case which may serve as the genesis for the development of important policy. One of the bidders protested to the Comptroller General claiming the award before it had been made. The Comptroller General then requested an abstract of all bids and other pertinent data which was refused by the Secretary of Navy on the grounds that such information is purely the business of the Department until after the award.

Purchasing operation has been on this basis for many years. After an award is made, an account of the transaction is sent to the Comptroller General as a routine matter. Usually the specifications are so drawn that the contract can go to the low bidder who is thrown out only for well-founded cause. In the past, when such action has been taken the Comptroller General's office has made reviews but decisions have been uniformly in favor of the Navy Department. Thus it is not clear what would be gained by setting up a duplicate system of clerical personnel to handle work which already is being done satisfactorily by the technical employees who actually determine the purchases and by the large Supplies and Accounts Division of the Navy.

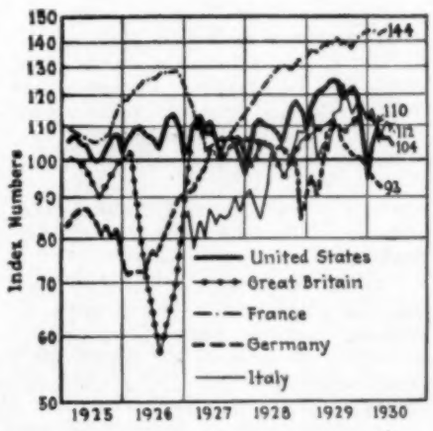
Exports of aircraft, engines and parts for July took a considerable slide from the million dollar marks established in May and June, but still managed to shade the export valuation for July, 1929. A total of $764,731 was recorded for July, 1930, as against $1,391,159 for May, $1,221,363 for June, and $735,922 for the previous July.

Shipments of parts more nearly retained the June level than did either of the two other classifications. In June, $201,495 worth of parts were shipped out; in July, $193,640. Thirty-one airplanes, seaplanes, and other aircraft were exported during July, a larger number than for any single month this year, with the exception of May and June.

Engines exported during July were of a lower unit cost than those exported in June, continuing a trend noticeable also in comparing June with May.

World Industry's Troubled Course Indicated in Chart Comparison

A CHART exhibiting the relative fluctuations in the United States, Great Britain, France, Germany, and Italy, of industrial production, money rates, wholesale commodity prices, and the cost of living, during the period from January, 1925, to the latest month in the current year for which statistics are available, has just been published by the National Industrial Conference Board. Curves were grouped by subject in order to facilitate the comparison of one country with another. In making these comparisons, however, some degree of caution was necessary, since basic data for the several countries are not comparable in all respects. Although an adequate discussion of the economic factors that influenced the oscillations of the various curves would be almost an impossible job, the effects of a number of important influences are clearly evident and may be summarizel.



The wide variations in the curves for production, reproduced herewith, reflect the troubled course of industry during the five years represented. In Great Britain, the coal strike and general strike of 1926 resulted in a loss of production which was partly met by France and which greatly aided the recovery of Germany from its acute financial and industrial depression of 1925. France passed through a period of readjustment in 1927, resulting from conditions attending the stabilization of its currency at a fraction of the pre-war value. The corresponding readjustment in Italy required a longer period of time. The relatively minor industrial depression in

the United States in 1927, the recovery in 1928, the continuation of the rise of industrial production until the "boom" of 1929, and the sudden fall toward the close of that year are revealed clearly and are too well known to require comment.

The recent drop in money rates is the aftermath of the international financial inflation of 1929 stimulated by the "bull" movement in stocks, which reached its peak in that year and collapsed. Movements of wholesale commodity prices have followed similar downward courses in all five countries since the middle of 1925, with the exception of France and Italy during 1925 and 1926. In general, the chart illustrates the fact that economic changes in the several countries are interrelated, even though the events which produce the changes may seem to possess only local significance.

Machine Age Exhibit Opens Next Week

A temporary exhibit depicting the rise of the "Machine Age" will be opened by the Museums of the Peaceful Arts in their new quarters at 220 E. 42nd St., New York City, on Sept. 12. The exhibit, prepared by some 100 American corporations and many individuals, will last until Nov. 15, and will stress the importance of machines, machine tools, and metallurgy in the progress of civilization.

Abrasive Standard Revision Announced by A.S.A.

A revised edition of the American Standard for the use, care, and protection of abrasive wheels has just been approved by the Standards Council of the American Standards Association. The original edition of the code, approved in 1926, required revision since the maximum speed for the vast majority of grinding wheels has increased from 6,000 to around 16,000 peripheral ft. per min., because of the introduction of synthetic resin and rubber-bonded wheels. The new code also provides for the use of steel castings for hoods on high-speed wheels, and gives a better classification of flanges and collars, including a new table of specifications for tapered flanges for use with high-speed wheels.

The American Foundrymen's Association and the A.S.M.E. have requested the A.S.A. to authorize the organization of a sectional committee to undertake the standardization of foundry equipment. A joint committee functioning under the auspices of the A.F.A. has been at work for a number of years on the standardization of color markings for foundry patterns. The tentative scope of the new work includes the standardization of such foundry equipment as pattern plates and molding machine parts affecting interchangeability of patterns, flask pins and holes, general dimensions of flasks for jobbing work, ladle and ladle shank sizes, ladle sleeves, stoppers, and nozzles, stock core print sizes, shapes and finish allowances, pattern markings, rapping plates, fillet sizes, and dowel pins for metal patterns and metal core boxes.

S.A.E. Holds Airplane Technical Session

Coming to Chicago to attend the tenth annual national air races, more than a thousand pilots and aeronautical members of the Society of Automotive Engineers attended a three-day technical session at the Palmer House. Six meetings held on Aug. 26, 27, and 28 covered all phases of aircraft development including engines, airplane design, spinning characteristics, control, and aircraft fuels. Included in the papers presented were: Manufacturing Costs of Aircraft Engines; Comparative Data on Power Plants for Motor Cars and Aircraft; The Possibilities of Radical Airplane Design; Weight Saving by Structural Efficiency (two papers), and Spinning Characteristics and Control.

Mechanical Spring Makers Form Organization

Following three preliminary meetings held at Toledo, Chicago, and New York, several mechanical spring manufacturers met at Toledo on Aug. 5 and organized the Spring Research Bureau. The Bureau has as an object the establishment of cordial personal relations between manufacturers of mechanical springs, the devising of ways and means to promote a feeling of good will between manufacturers and their customers, a mutual study of cost accounting systems and the costs of manufacture, the improving and developing of commercial methods in the manufacturing and marketing of mechanical springs, obtaining and diffusing information on general trade matters, and co-operating with all government agencies and departments and other organizations in standardization and association work. Thirty-one plants have been represented at the four meetings. Malcolm Baird, 232 Delaware Ave., Buffalo, N. Y., is acting as secretary.

BUSINESS ITEMS

The Pacific Foundry Co. has moved from 2418 Fifty-third St. to 718 E. Sixty-first St., Los Angeles. The plant now operated by the Pacific company was formerly occupied by Emmett & Sons, which discontinued operations following the recent death of W. W. Emmett.

The Shand & Jurs Co., Eighth & Carlton Sts., Berkeley, Calif., has completed a warehouse covering 7,200 sq.ft. of floor space, and has also purchased ground adjacent to the present plant for future expansion.

The Harron, Rickard & McKone Co., 1600 Bryant St., at 15th, San Francisco, Calif., has recently moved into a new building in which the company has established a permanent machine-tool exhibit. The new building occupies space measuring 120x200 ft., with spur track service at the rear. Tracy W. Harron is president and F. C. Edmonds is sales manager at San Francisco. H. L. Brown is head of the machine-tool department.

The Babcock & Wilcox Co. has installed a powerful X-Ray plant at the Barberton (Ohio) works to be used primarily for routine inspection of welded seams in pressure vessels, heat exchangers, and similar equipment.

The Wrought Washer Manufacturing Co., 46 South Bay St., Milwaukee, is planning a new plant at Oklahoma Ave. and the Milwaukee road main line tracks.

The B. F. Keith Co., Atlanta, Ga., has been appointed representative in Florida, Georgia, South Carolina, and Northern Alabama of the Jewell Electrical Instrument Co., 1650 Walnut St., Chicago.

Plans for remodeling the machine shops of the Lindenschmidt Co., Evansville, Ind., have been announced by Val Lindenschmidt, general manager. The building will be remodeled to provide for installation of special equipment to be used in heavy metal work.

The Chard Lathe Co., Newcastle, Ind., has been sold to Harry E. Jennings, president of the Citizens' State bank there, by the receiver. Equipment of the plant will be sold at private sale.

The Ruselite Co., in care of the Milwaukee Die Casting Co., 291 Fourth St., Milwaukee, has been organized to produce die castings from an alloy containing chromium, molybdenum, and aluminum. No new construction is planned. Henry F. Schroeder is president and general manager.

The Carboloy Co. has moved its general offices from New York City to 2481 East Grand Boulevard, Detroit.

The Crane Co., Chicago, has reopened its foundry at Chattanooga, Tenn.

PERSONALS

S. R. Robinson, formerly foundry manager of the Industrial Brownhoist Corporation, Bay City, Mich., has been appointed metallurgical engineer, Ohio Steel Foundry Co., Springfield, Ohio. The Ohio Steel Foundry Co. recently purchased the steel foundry of the Industrial Brownhoist Corporation.

R. G. Clark, formerly with the Earl A. Buckley advertising organization, Philadelphia, has been appointed sales manager of the Riehle Bros. Testing Machine Co., Philadelphia.

E. W. Michael has been appointed director of trade sales of Valentine & Co., New York. Frank P. Connolly has been made director of sales promotion, and M. F. Emrich, director of industrial sales.

T. Howe Nimick, assistant general sales manager of the Colonial Steel Co., Pittsburgh, has been elected a director of the Pennsylvania Trust Co. of Pittsburgh.

Leon V. Quigley of the Bakelite Co., New York, will present a paper entitled "Phenol Resinoid Molding Technique—Consideration of Engineering Factors

Involved in the Replacement of Metals by Synthetic Plastics" at the National Metal Congress in Chicago as a part of the sessions of the A. S. M. E.

E. J. Rossback, treasurer of the Association of American Engineers in France, T. A. Vander Willigen, Hamphreys & Glasgow, Ltd., and Millard Shaler have been designated as United States delegates to the International Congress of General Mechanics being held at Leige, Belgium, from Aug. 30 to Sept. 7.

F. A. Rumbarger has been appointed Pittsburgh representative of the Browning Crane Co., Cleveland.

Joseph P. Taylor, consultant in machine shop practice with the Midvale Co., Philadelphia, has retired.

H. W. Stone, formerly president of the U. S. Hoffman Machinery Corporation, New York City, is president and general manager of the newly organized Nutyp Tool Corporation, Oswego, N. Y., organized to take over the business and assets of the Oswego Tool Co., as announced in *American Machinist* on Aug. 28. E. B. Russell is vice-president and treasurer. E. W. Fulton is vice-president and works manager. Mr. Russell was formerly head of the Security Finance Co., and sales manager for Peerless Mills, Inc., and Mr. Fulton has, for several years, been general manager of the Oswego Tool Co. Expansion of the plant is under consideration by possible merger in the near future and new tools are to be added to the Oswego line.

M. J. Walsh, foundry foreman of James Leffel & Co., Springfield, Ohio, since 1912 and who joined the company in 1892 has retired from active service.

OBITUARIES

Frank L. Driver, chairman of the board and founder of the Driver-Harris Co., Harrison, N. J., died on Aug. 26 in Brussels, Belgium. Mr. Driver went to Belgium in 1926 for his health and has lived there most of the time lately.

James Lyon, 46, tool engineer for the Continental Can Co., died recently at his home in Syracuse, N. Y., following a short illness.

Thomas Glendinning, 81, retired engineer, Lachine, Quebec, died at his residence in Lachine on Aug. 20. He was in the employ of the Dominion Bridge Co. for 25 years and later with the Allis Chalmers Co. for 20 years.

Thomas Gray Bennett, 80, president for 21 years of the Winchester Repeating Arms Co., died on Aug. 19 at New Haven, Conn. He joined the Winchester company after graduation from Yale university in 1870 and was president from 1890 to 1911, when he resigned. Mr. Bennett continued as a consulting director until his death.

Isadore Sternefeld, special representative of the Westinghouse Electric International Co., died on Aug. 21 in Paris as a result of injuries sustained in an accident the previous day. Mr. Sternefeld has been associated with Westinghouse for 36 years.

T. C. Uran, one of the founders of the Solid Steel Co., predecessor of the American Steel Foundries, Alliance, Ohio, who has been more recently a banker in that city, died there recently.

William Lindsay Wotherspoon, 55, formerly consulting engineer for the International Nickel Co. Inc., New York City, died recently at Phoenix, Ariz.

FORTHCOMING MEETINGS

STEEL FOUNDERS' SOCIETY OF AMERICA, INC.—Regular meeting, William Penn Hotel, Pittsburgh, Pa., Sept. 10-11. October meeting at Pennsylvania Hotel, New York City, on Oct. 23, the day preceding the New York meeting of the American Iron & Steel Institute. G. P. Rogers, 932 Graybar Bldg., New York City, is managing director.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION—Annual convention, Hotel Sherman, Chicago, Sept. 10-12.

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION—Cost Conference, Hotel Clifton, Niagara Falls, Ont., Canada, Sept. 22-23. Ernest F. DuBrul, 1415 Enquirer Bldg., 617 Vine St., Cincinnati, Ohio, is general manager.

NATIONAL METAL CONGRESS—Twelfth annual Congress and Exposition, Stevens Hotel, Chicago, Sept. 22-26. W. H. Eisenman, secretary of the A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio, is director.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, Engineering Societies Bldg., 29 West 39th St., New York, N. Y. The following meetings are scheduled:

Iron & Steel and Machine Shop Practice Divisions, annual fall meetings, Stevens Hotel, Chicago, Sept. 22-26. Address P. T. Wetter at above address.

French Lick Meeting, French Lick Springs Hotel, French Lick, Ind., Oct. 13-15.

Fifty-first annual meeting, Engineering Societies Bldg., Dec. 6.

AMERICAN INSTITUTE OF MINING & METALLURGICAL ENGINEERS — Annual fall meeting of Iron & Steel and Institute of Metals Divisions, Stevens Hotel, Chicago, Sept. 22-26. T. T. Read, Engineering Societies Bldg., 29 West 39th St., New York City, is secretary.

AMERICAN WELDING SOCIETY—Annual fall meeting, Congress Hotel, Chicago, September 22-26. W. M. Spraragen, 29 W. 39th St., New York. N. Y.

AMERICAN SOCIETY FOR STEEL TREATING—Annual Convention, Stevens Hotel, Chicago, September 22-26. W. H. Eisenman, 7016 Euclid Ave., Cleveland.

NATIONAL SAFETY CONGRESS—Nineteenth Annual, to be held at Fort Pitt and William Penn Hotels, Pittsburgh, from Sept. 29 to Oct. 3. Metals Section meetings will be held on Tuesday and Wednesday mornings and Thursday afternoon.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION — Semi-Annual meeting, Hotel Clifton, Niagara Falls, Ont., Canada, from Sept. 29 to Oct. 1.

SOCIETY OF AUTOMOTIVE ENGINEERS — Production meeting, Hotel Book-Cadillac, Detroit, Oct. 7-8. R. S. Burnett, director, production activities, 29 West 39th St., New York City.

GRAY IRON INSTITUTE, INC. — Third Annual Convention at Hotel Cleveland, Cleveland, Ohio, October 8. Arthur J. Tuscany, Terminal Tower Bldg., Cleveland, is manager.

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION—29th Annual Convention, Hotel Aspinwall, Lenox, Mass., October 13-15. Ernest F. DuBrul, 1415 Enquirer Bldg., 617 Vine St., Cincinnati, Ohio, is general manager.

SOCIETY OF INDUSTRIAL ENGINEERS—17th National Convention, Mayflower Hotel, Washington, D. C., Oct. 15-17. George C. Dent, 1815 Engineering Bldg., 205 W. Wacker Drive, Chicago, executive secretary.

NINTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING —In Grand Central Palace, New York City, Dec. 1-6.

WESTERN METAL CONGRESS AND EXPOSITION—Second National, Civic Auditorium, San Francisco, Calif., Feb. 16-20, 1931. Under auspices of A.S.S.T. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine-tool business

THE following reports, gathered from the various machinery and machine-tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW YORK

Pollyanna seems to have infused New York machinery and machine-tool dealers with some of her everlasting cheerfulness and optimism. So far only a few of them can report increases in inquiries and still fewer report increases in orders, but the atmosphere seems charged with good prospects waiting until after Labor Day to become tangible. Little hope is held that Westinghouse will act soon on its list of ten tools for Newark, or that New York City dealers will get any of the tools for the state prison at Auburn. The prison is in Syracuse dealers' territory, and though the inquiry is issued from Albany, in New York City territory, dealers here are expected to keep hands off. No further information has been divulged on the American Locomotive list. One dealer reported sales of several lathes, a bending brake, and a shaper to three construction companies, and several other orders, making for him the best week of the year.

NEW ENGLAND

Machine-tool demand is slower in the New England section, and recent signs of industrial activity do not tend to stimulate buying. It is probable that the latter half of August developed less new business than the first half. Foreign placements have been the feature of a quiet market. Inquiries are lagging and little interest is being displayed by domestic buyers. Following a renewal of activity early in August, grinding machine demand has fallen off again.

Despite unfavorable features there is plenty of confidence for the future. Officials anticipate closings on long-outstanding inquiries during the fall months. Some used-tool dealers report a slight step-up in distribution during the current week, but this condition is by no means general.

DETROIT

There is no tangible evidence of an improvement of the machinery and machine-tool business in the Detroit area. Dealers still express a great deal of optimism for the future and a good spirit prevails throughout the trade, but there is very little actual business being done.

Conditions here are worse than they have been in many years and the long-expected upward movement, as far as the machinery business is concerned, has not materialized. Automobile manufacturers are buying practically nothing, and there seems no likelihood that they will begin to do so in the near future.

CANADA

Marked improvement is noted in the machinery and machine-tool market in Canada. The metal-working industry generally has quickened its pace during the last fortnight. Steel plants are resuming production on an increased scale, and automotive output now makes a more favorable comparison with 1929.

Several companies benefit from extensive orders just placed by the Beauharnois Power Corporation. Orders for newsprint machines are keeping manufacturers in that field busy. Demand for electrical supplies is well maintained.

POLLYANNA'S perpetual pleasantness, no matter what might happen, is reflected in the attitude of machinery and machine-tool dealers of the country at the present time. Despite the prevailing pessimism of prospective purchasers, they have fully qualified themselves for business' pulmotor brigade by offering to the trade 190 new tools in the past two months, about 10% better than an average which includes the best months of the year under boom conditions. Increases in inquiries are coming slowly, increases in orders yet more slowly, but still pæans of progress are being sung.

NEW YORK dealers expect Labor Day to bring more labor, and point to three sizable inquiries of the last few weeks as indications. New England sales to foreign buyers have featured a comparatively dull market, though used-tool purchases are coming up and the fall is expected to bring a sharp upturn in the sales curve. Detroit's automobile manufacturers fail to take even pointed hints to buy until the public indicates a greater interest in their new models. Canada, where relief from heat waves is noticed sooner, has noted a decided quickening of pace in the entire metal-working industry.

CHICAGO has so far displayed her newly adopted martial attitude only in marking time, but expects to start marching in October. Indianapolis reports inquiries from various sections as an aftermath of the increase in employment there, though orders so far are principally for export. Cincinnati manufacturers are surprised at the number and diversity of inquiries received at this usually slow season, though their pleasant surprise has left dealers unaffected. Southern District purchasers, not believing confident business prognosticators, are holding to a battle cry of "Better a live laggard than a dead hero!"

CHICAGO

While optimism still is expressed in some quarters with reference to the resumption of a degree of activity in the machine-tool industry in the near future, it is not general. August business in most cases is reported to be about on a par with that of July, with no present indications that it soon will improve, October now being looked forward to as the date for the termination of the long-continued dull spell. Inquiries from the automotive industry have not come up to expectations. Inquiries from other industrial sources are limited to single tools for replacement. Some additional buying by the Majestic Household Utilities Co. is reported, as also are some tentative inquiries from farm implement manufacturers. Demand for used tools shows some improvement.

INDIANAPOLIS

Little change is noted in the machinery and machine-tool trade here, but there are indications of a resumption of a fair volume of business this fall. Reports from various parts of the state show that users of machine tools are putting more men to work, and some inquiries are being received here by local manufacturers and dealers. The manufacturers of heavy tools seem better fixed than most others and say business is continuing good. They have considerable export business.

The electrical industry continues to be one of the best buyers of special machinery.

Inquiries now are being received from the farm implement factories, particularly those manufacturing plows and discs. The iron and steel industry continues to be an indifferent buyer. Some factories are making a few replacements, but the volume is not what it should be. The aviation field is promising and demand for small tools is fair. A fair demand is seen for coal mining machinery much of it being for machine-shop equipment, though some large additions are being made.

CINCINNATI

Some machine-tool manufacturers made slight gains in August, but the majority reported sales at the same low level. In the past week there was a slight upward tendency, but there was no change in the general market and business continued spotty and dull.

Selling agents reported a slightly-improved market and received a number of inquiries from local and adjacent territory. This branch of the trade does not expect a great improvement in the market the present month, but confidence is expressed that there will be a marked increase in the demand in the next four or five weeks.

The number of inquiries received in the week by manufacturers was much larger than naturally would be expected in the present dull period, and they give more than a little encouragement. These were well scattered geographically and well diversified as to sizes and types.

SOUTHERN DISTRICT

While a slight improvement in the general machinery and machine-tool market of this district was noted the past fortnight, the uncertainty of conditions does not warrant any wave of enthusiasm and most dealers are skeptical of making predictions. There already has been noticed a slowing up of buying in many fields, and machinery and machine-tool users are reluctant to overbuy and are cautious in investments of the kind made.

Used machinery and tools, as has been customary during past months, predominated in volume of sales. Fewer sales of new equipment were reported for the past two weeks, but there has been a noticeable decrease in the amount of used material in the hands of dealers, a satisfactory situation, they declare.

Activity continues in the Southwest area, while the Central and Eastern divisions of this territory offer an unfavorable contrast. Railroads are doing little or no buying, and most orders are so scattered as to industries as to form no definite classification. Prices are steady to slightly off for used machinery and tools, while new machinery and machine-tools hold firm in face of satisfactory deliveries.

BUSINESS • BAROMETER

The bad news is out, and until pessimists can accumulate a fresh supply, business should improve

THEODORE H. PRICE
Editor, Commerce and Finance, New York

TAKEN collectively, last week's commodity markets were the most interesting feature of the situation. They have not advanced much, but they have stopped declining, and a western agricultural paper that is supposed to be very influential asserts that the business depression will end as soon as it is clear that the staples of civilization have ceased to decline.

Therefore, it is encouraging to note that cotton is up; that silk is improving; that rubber is being bought comfortably by consumers at a price so much below the cost of production that it cannot go much lower; that the hide and leather market appears to be able to absorb all offerings; that sugar has advanced quite sharply, and that No. 7 coffee at about 5 cents a pound, which is almost the record low, must be near bottom, although the liquidation of the Brazilian stocks will, of course, require a very long time.

The details are not, however, important. The fact is that the fear of any further panicky decline in raw materials seems to have been dismissed. With its dismissal a revival of hope amongst American business men is to be noted. If the pessimists were not so energetic in exploiting the unemployment and low prices that are so much talked about, it is quite possible that we might see a noticeable improvement in business with the commencement of the autumn.

Definite information with regard to unemployment seems difficult to obtain. The Census Report puts the number who are out of work at about 2,500,000, but the newspapers of last Tuesday morning announce that the employment bureau maintained by the City of New York was unable to fill a number of vacant positions because the expert labor required was not to be had. This is probably the case in many other instances. The expert laborer or trained specialist can generally find work, but the man without skill often declines the only work for which he is fitted. Therefore, a critical reading of the published information with regard to unemployment may be advisable before it is accepted at its face value.

Aside from the steadiness of the commodity markets the distributive trade reported by chain and department stores is the most important if not the most encouraging feature of the outlook. The turnover is not fully up to last year, but it is very satisfactory in some lines, and it is asserted that in many cases, including the larger chains, an actual increase in business would be shown if the turnover were measured by volume.

The steel industry is still slack, but signs of an early increase in output are fairly clear. The production of automobiles continues to show a decrease as compared with last year, with small probability that it will gain much in the near future. But it is hardly to be expected that the farmers of the West and the South can buy as much as they did, when wheat and cotton are 30 to 40 per cent below the level of a year ago.

There is, however, surprisingly little complaint from the agricultural regions and one well-informed correspondent writes us that the farmers of the country will remain inarticulate until after the November elections, when aggressive action in their behalf may be expected from the newly chosen Congress. If the ballots cast show that radicalism has less support than it claims, the effect may be salutary, but if the insurgents of both parties succeed in obtaining a sufficient following to embarrass the administration the result may be a further and serious interruption in business. Therefore, it would be well to watch the trend of political developments very closely.

President Hoover's attempt to provide jobs for the unemployed in this country has had a good effect, and contracts calling for the immediate expenditure of approximately $200,000,000 will shortly be signed. The Thames Embankment in London is an illustration of the efficacy of this method of providing jobs for the jobless. It might be well for some of our American statesmen who are opposing the Hoover Government to look into this bit of British history. Certainly it is not to be denied that the Government can banish hard times if it spends enough money, and it is equally plain that if the money is wisely spent the assets of the Government or municipality that does the spending will be substantially increased.

Perhaps it was the subconscious appreciation of these facts that led to an an improvement in the tone of the stock market last week. There was no reckless buying. Many "busted booms" seem to be beyond repair, but a better feeling was apparent, and stocks are, upon the whole, higher. There is nothing to put them down, and the ease of money is almost a guarantee of higher prices for those securities which pay interest or dividends.

Therefore, conservative investors are carefully scrutinizing the list of stocks for sale, and some banking houses tell us that the amount of money thus attracted to the market is almost incredibly large. They claim that this explains the immunity to the bear attacks that are made upon prices from time to time, and that we will shortly see a further advance. As to this some doubt may be expressed, but it cannot be denied that there is a quickening of interest in the stock market and that it is easier to put it up than down. Certainly most of the bad news is out, and until the pessimists can accumulate a fresh supply an improvement in business as well as speculation seems possible.

THE BUSINESS WEEK

September 3, 1930

AFTER about two weeks delay due to drought scare, the signals of the beginning of definite business recovery, which in June we said would appear early in August, begin to flicker faintly amid the encircling gloom. Our index, turning slowly from the low level reached during the first two weeks of the month, has risen to 89% of normal as compared with 87.2% last week and 111.1% last year. Nearly every important weekly indicator has turned upward this week, while a year ago almost all were sliding steadily down. Steel activity, coal production, and carloadings are up more than seasonally; electric power output is increasing slowly; building is resisting seasonal decline; general trade volume is rising nearer to normal levels; and commodity prices have ceased their rapid decline. Whether this upturn is to carry us beyond the seasonal hump during September and bring business back to normal by the end of October depends now on two things only: whether the Federal Reserve will keep the credit clock wound up by buying bills and securities steadily, and whether business brains will jump energetically into the job after Labor Day. From now on business will be better, or much worse, as we choose.

©The Business Week

Copyrighted
Theodore H. Price Publishing Corporation
95 Broad St., New York

THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

A DULL and featureless market in finished materials marked the close of August. Steel prices remained inert, while those of paint materials continued to decline. Last week witnessed a decided jump in price of steel scrap at Pittsburgh. This week, scrap non-ferrous metals rose a fraction of a cent at New York. This firmness in scrap, generally, even though other materials show hesitation, is taken as a good omen in the trade. Buying of steel structurals continues up to average volume. Railway requirements, however, are still small, with little hope of recovery while earnings of the carriers are at present levels. Most of the other branches of the metal trade are resigned to the expectation that Autumn will bring forth a renewal of demand.

(*All prices as of August* 29, 1930)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$16.69@$18.19
Northern Basic	19.89@ 20.39
Southern Ohio No. 2	19.89@ 20.39
NEW YORK—Tidewater Delivery	
No. 2 Southern (silicon 1.75@2.25)	18.00@ 18.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	14.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	20.00
Virginia No. 2	18.75@ 19.25
Basic	22.29
CHICAGO	
No. 2 Foundry, local (silicon 1.75@2.25)	19.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	18.20
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.63@ 20.13
Basic	19.63@ 20.13
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	1.90@2.00	3.35†	3.00	3.40†
No. 12	1.95@2.05	3.45†	3.10	3.45†
No. 14	2.05@2.15	3.55†	3.20	3.50†
No. 16	2.15@2.25	3.65†	3.30	3.60†
Black				
Nos. 18 to 20	2.25@2.35	3.85†	3.40	3.70
No. 22	2.40@2.50	4.00†	3.55	3.85
No. 24	2.45@2.55	4.05†	3.60	3.90
No. 26	2.55@2.65	4.15†	3.70	4.00
No. 28	2.70@2.80	4.75†	3.85	4.15
Galvanized				
No. 10	2.35@2.40	3.90†	3.65	3.55
Nos. 12 to 14	2.45@2.50	4.00†	3.75	3.65
No. 16	2.55@2.60	4.10†	3.85	3.75
No. 18	2.70@2.75	4.25†	4.00	3.90
No. 20	2.85@2.90	4.40†	4.15	4.05
No. 22	2.90@2.95	4.45†	4.20	4.10
No. 24	3.05@3.10	4.60†	4.35	4.25
No. 26	3.30@3.35	4.85†	4.60	4.50
No. 28	3.55@3.60	5.10†	4.85	4.75

*Light Plates. †400 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
⅝	.58½	2.875	2.469	.203
¾	.76½	3.5	3.068	.216
⅞	.92	4.0	3.548	.226
1	1.09	4.5	4.026	.237
1¼	1.48	5.563	5.047	.258
1½	1.92	6.625	6.065	.28
2	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	B.w.g. and Fractions	Outside Diameter in Inches—Price per Foot: ⅛	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23			
.049″	18	.17	.18	.19	.20	.21	.23	.25			
.065″	16	.19	.20	.21	.22	.23	.25	.27			
.083″	14	.20	.22	.23	.24	.25	.27	.29			
.095″	13	.21	.23	.25	.26	.27	.29	.31			
.109″	12	.22	.24	.26	.27	.28	.30	.32			
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33			
.134″	10	.24	.26	.28	.29	.30	.32	.34			

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	7.00	6.00	6.20
Hoop steel	3.75†	4.00	3.75†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.85†	5.30	5.00†
Cold fin., round or hexagon‡	3.40	3.65	3.35
Cold fin., flat or square‡	3.90	4.15	3.85
Structural shapes	3.10†	3.00	3.00†
Soft steel bars	3.10†	3.00	3.00†
Soft steel bar shapes	3.10†	3.00	3.00†
Soft steel bands	3.40†	3.65	3.20†
Tank plates	3.10†	3.00	3.00†
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, ⅜-in. thick by ¾-in. wide. †400 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{3}{32}$ to $\frac{1}{8}$, 7.35c. per lb.

METALS

Warehouse Delivery Prices in Cents Per Lb. for Small Lots:

Copper, electrolytic, New York			12.50
Tin, Straits, pigs, New York			32.50@33.50
Lead, pigs, E. St. Louis	5.35	New York	6.50@ 7.00
Zinc, slabs, E. St. Louis	4.30	New York	6.25@ 7.25

	New York	Cleveland	Chicago
Antimony, slabs	10.00@10.50	10.25	10.75
Copper sheets*	20.75	20.75	20.75
Copper wire*	13.00	13.87½	13.12½
Copper, drawn, round*	19.25	19.25	19.25
Copper tubing*	23.00	23.00	23.00
Brass sheets, high*	17.87½	17.87½	17.87½
Brass tubing, high*	22.75	22.75	22.75
Brass rods, high*	16.12½	16.12½	16.12½
Brass wire, high*	18.37½	18.37½	18.37½

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%†	23.30	24.30	23.30
Zinc sheets (casks)	9.75@10.25	11.25	10.11
Solder (½ and ½)	24.50	23.50	22@24

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	50.00
Commercial genuine, intermediate grade	37.00
Anti-friction metal, general service	31.00
No. 4 babbitt, f.o.b.	10.50

†F.O.B.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	9.00 @9.25	9.00	8.75@ 9.25
Copper, heavy, and wire	8.25 @8.50	8.75	8.00@ 8.50
Copper, light, and bottoms	7.50 @7.75	8.50	7.00@ 7.50
Heavy lead	4.25 @4.37½	4.00	3.50@ 4.00
Tea lead	2.00 @2.25	2.50	2.50@ 3.00
Brass, heavy, yellow	5.25 @5.50	5.00	5.00@ 5.50
Brass, heavy, red	7.25 @7.50	7.75	7.25@ 7.75
Brass, light	4.25 @4.50	4.00	4.50@ 5.00
No. 1 rod-brass turnings	5.37½@5.50	5.00	5.00@ 5.50
Zinc	2.00 @2.25	1.50	1.75@ 2.00

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13	$0.16	$0.15
Cotton waste, colored, per lb.	.09½	.12	.12
Wiping cloths, washed, white, per lb.	.13½	38.00 per M	.16
Sal soda, per lb.	.01½	.02	.02
Roll sulphur, per lb.	.028	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.132	....	.137
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.65	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30%	30 –5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	50%	50–10%	50%
Second grade	60%	60– 5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.031	$0.031	$0.033
Cold fin. shafting	per lb.	.034	.034	.036
Brass rods	per lb.	.1612½	.1612½	.2125
Solder (½ and ½)	per lb.	.245	.245	.335
Cotton waste, white	per lb.	.13	.13	.10@.13½
Disks, aluminumoxide mineral, cloth, No. 1 6-in. dia	per 100	4.59	4.59	3.60
Lard cutting oil	per gal.	.65	.65	.75
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65%*	50–10%*	50–10%*

*List prices as of April 1, 1927

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville,		2.50@2.60
Coke, prompt foundry, per net ton	Connellsville,		3.50@4.85
White lead, dry	100 lb. kegs	New York,	13.75
White lead, in oil	100 lb. kegs	New York,	13.75
Red lead, dry	100 lb. kegs	New York,	13.75
Red lead, in oil	100 lb. kegs	New York,	15.25

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65%
Larger, up to 1 x 30-in., full kegs, list less	65%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65%
Larger, list less	65%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.50
Structural, round head, broken kegs, net	6.00
Tank, 7/16-in. dia. and smaller, list less	65%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65%
Larger, up to 3-in., list less	65%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$8.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Calif., Oxnard — Oxnard Union High School Dist., B. F. Barr, Clk.—will receive bids until Sept. 9, for 16 in. ball bearing hand planer and jointing machine equipped with 3 hp. motor.

Ill., Chicago—Dept. of Public Works, R. W. Wolfe, Comr., will receive bids until Sept. 8 for 18 in. x 14 ft. heavy duty motor driven geared head quick change engine lathe, also motor driven No. 2 University milling machine complete with accessories for William Hale Thompson pumping station, 49th St. and Western Ave.

Mass., Cambridge (Boston P.O.)—New Method Die Co.—hardening furnace and blower, also pyrometer.

Opportunities for Future Business

Calif., Los Angeles—Consolidated Steel Corp., 1200 North Main St., plans the construction of a plant at Slauson and Eastern Aves. Estimated cost to exceed $100,000. Private plans. Noted Aug. 14.

Calif., Los Angeles—Southern California Edison Co., 1200 North Main St., awarded contract for the construction of a 6 story, 50 x 150 ft. garage on South Hope St. Estimated cost $275,000.

Calif., San Francisco—Royal Show Case Co., 759 McAllister St., awarded contract for a 2 story shop and factory. Estimated cost $50,000.

Calif., San Francisco—Truscon Steel Co., Call Bldg., is having plans prepared for a 1 story plant at Carroll and Newhall Sts. Estimated cost $50,000. Private plans.

Calif., South San Francisco—Pacific Coast Steel Co., 215 Market St., San Francisco, is having plans prepared for the construction of a plate manufacturing shop here. Estimated cost $60,000. Private plans.

Con., Danbury—Danbury & Bethel Gas & Electric Light Co., 238 Main St., had plans prepared for the construction of a warehouse, garage and service building on State St. Estimated cost $50,000. Sunderland & Watson, 248 Main St., Archts.

Conn., Stamford — Stamford Gas & Electric Co., awarded contract for the construction of a garage and electric service building. Estimated cost $50,000.

Ga., Valdsosta—Consumers Veneer Co., H. H. Rhymes, Jr., and J. M. Clark, plans the construction of a veneer plant here.

Ill., Belleville—Baker-Nagle Co., 913 Freeburg Ave., awarded contract for the construction of a 1 story, 95 x 135 ft. addition to stove plant. Estimated cost $40,000.

Ill., Niles Center—Chicago Rapid Transit Co., 72 West Adams St., Chicago, plans extension and improvements including new shop unit here. $377,000. Total estimated cost $6,872,000.

Ill., Quincy—Bd. of Education, W. E. White Secy., Musselman Bldg., will receive bids about Oct. 1 for the construction of a school including machine shop, etc. at 14th St. between Main and Jersey Sts. Estimated cost $1,300,000. J. D. Chubb, 109 North Dearborn St., Chicago, and Behrensmeyer & Haffner, Western Catholic Union Bldg., Assoc. Archts. Noted May 8.

Ind., Anderson—Powercraft Motors Corp., acquired Anderson Carriage Works, and plans to remodel plant for the manufacture of power motors, engines, powercraft and accessories. Estimated cost $60,000.

Ind., Indianapolis—Standard Oil Co., 137 West 11th St., awarded contract for the construction of a service station at New York St. and Capitol Ave. Estimated cost $42,300.

Ind., Terre Haute — American Can Co., awarded contract for the construction of a 3 story, 180 x 350 ft. factory. Estimated cost $1,000,000. Noted July 24.

La., Alexandria — U. S. Veteran's Bureau, Washington, D. C., will receive bids until Oct. 7, for the construction of a garage building, here.

Me., Westbrook—Portland Water District, 16 Casco St., Portland, will receive bids until Sept. 8, for the construction of a 2 story garage and repair shop, etc., here. Estimated cost $40,000. J. C. and J. H. Stevens, 477 Congress St., Portland, Archts.

Mass., Cambridge (Boston P.O.)—American Oil Co. of Massachusetts, c/o R. T. Jackson, 44 School St., Archt., awarded contract for substructure of a 1 story garage and service station at 104 Mt. Auburn St. Estimated cost $60,000.

Mass., Fitchburg—Simonds Saw & Steel Co., 55 North St., plans the construction of a 360 x 550 ft. manufacturing plant. Estimated cost $1,000,000. J. O. DeWolf, 45 Bromfield St., Boston, Engr.

Mass., Jamaica Plain (Boston P.O.) Shell Eastern Petroleum Products Co., 141 Milk St., Boston, awarded contract for a service station at Columbus Ave. and Center St. here.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Mass., Natick — Mexican Petroleum Corp., Park Sq. Bldg., Boston, plans the construction of a 1 story service station at East Central and Union Sts., here. Estimated cost $40,000. Private plans.

Mass., New Bedford—A. Akulski, 82 Cove St., is having plans prepared for a 1 story garage, repair shop and service station at Cove and Viall Sts. Estimated cost $40,000. Private plans.

Mass., Quincy (Boson P. O.)—Bethlehem Ship Building Corp., East Howard St., awarded contract for a 2 story, 100 x 200 ft. warehouse. Estimated cost to exceed $40,000.

Mass., Westfield—City, c/o M. W. Molaney, 23 Pearl St., Springfield, Archt., awarded contract for the construction of a 3 story, 75 x 180 ft. boys trade school on Bartlett St. Estimated cost $150,000.

Minn., Hibbing — Great Northern Iron Ore Properties, 509 3rd Ave., will soon award contract for the construction of a 2 story warehouse garage, and office. Estimated cost $60,000. B. M. Conklin, 509 3rd Ave., Archt. Arthur Mining Co., 509 3rd Ave., Engr.

Mo., Jefferson City—State Highway Commission, c/o T. H. Cutler, Ch. Engr., awarded contract for a 3 story headquarters, garage and storage building. $126,790. Noted Aug. 7.

N. J., Elizabeth—Bd. of Education, 417 South Broad St., is having sketches made for the construction of a 3 story boys vocational school. Estimated cost $500,000. H. P. Brady Inc., 333 North Broad St., Archt.

N. J., Hoboken—Cornell & Underhill, 311 Spring St., New York, N. Y., awarded contract for a 2 story plant for the manufacture of iron pipe at 14th and Madison Sts. here. Estimated cost $40,000.

N. J., Montclair—Public Service Production Co., 80 Park Pl., Newark, plans the construction of a 1 story garage, shop, service station, etc. 101 Greenwood Ave. here. Estimated cost $150,000. Private plans.

N. J., Newark—R. C. Klemm, 944 Broad St., Archt., will receive bids about Sept. 15 for the construction of a 1 story, 25 x 100 ft. factory and garage at 1820 Oxford St. for A. Kaminski, c/o architect. Estimated cost $40,000. Noted Aug. 14.

N. J., New Brunswick—Goetze Gasket & Packing Co., Allen Ave., awarded contract for a 1 story addition to factory. Estimated cost $40,000.

Pa., Greenville—Sterling Oil Co., R. S. Newton, in charge of const., Emlenton, is having plans prepared for the construction of a 1 story service station at Penn and Main Sts., here. Estimated cost $40,000. H. C. Clepper, 103 Vandergrift Bldg., Pittsburgh, Archt.; also awarded contract for a service station on Franklin Ave. $40,000.

Pa., McKeesport—Fort Pitt Steel Casting Co., Houston Ave., awarded contract for a 2 story, 31 x 68 ft. addition to warehouse.

Pa., Neville Island—Gulf Refining Co., Frick Bldg. Annex, Pittsburgh, awarded contract for a refinery including 45 x 128 ft. machine shop, 50 x 80 ft. office, etc. here. Estimated total cost $1,500,000.

Pa., Oil City—Independent Oil Refining Co., S. Erickson, awarded contract for the construction of a 1 and 2 story shop building and laboratory at Seneca St. Ext. Estimated cost $40,000.

Pa., Pittsburgh—Brinker Supply Co., Clark Bldg., (machinists) awarded contract for a 1 story, 30 x 70 ft. workshop on Hamilton Ave.

Pa., Uniontown—Richmond Radiator Co., 1480 Broadway, New York, N. Y., awarded contract for a group of buildings, including 1 story, 22 x 48 ft. machine shop, 1 story, 16 x 48 ft. blacksmith shop, 50 x 160 ft. warehouse, and 32 x 56 ft. gas boiler plant here.

Pa., Washington — Bd. of Education, R. C. Buchanan, Pres., Jefferson and Wylie Aves., will receive bids until Sept. 20, for the construction of a junior and senior high school including 2 story, 72 x 125 ft. shop building, etc. at Jefferson and West Hallam Aves. Estimated cost $900,000. E. B. Lee, 1210 Chamber of Commerce Bldg., Pittsburgh, Archt. and C. L. Woolridge, Fulton Bldg., Pittsburgh, Const. Engr. Noted Apr. 24.

Pa., Wilkinsburg—Henny Pittsburgh Co., 1121 Penn Ave., Pittsburgh, will soon award contract for a 2 story, 66 x 115 ft. garage, etc. at Penn Ave. and Montier St. B. H. Lawson, Starr Bldg., Pittsburgh, Archt.

W. Va., Wheeling—Wheeling Garage Corp., will soon receive bids for the construction of a 2 story, 33 x 128 ft. garage on Chapline St. Estimated cost $50,000.

Wis., Lodi—Wrought Washer Mfg. Co., 46-54 South Bay St., Milwaukee, is having plans prepared for a 1 story, 65 x 500 and 65 x 385 ft. steel rolling mill and storage building here. Klug & Smith Co., 69 East Wisconsin Ave., Milwaukee, Engrs.

Wis., Milwaukee—Filer & Stowell Co., 219 Becker St., (iron works) is receiving bids for a 3 story, 70 x 81 ft. factory. Private plans.

Ont., London—Taylor Electric Co., 526 Adelaide St., awarded contract for addition to plant for the manufacture of electrical supplies. Estimated cost $30,000.